THE
TROPICAL AGRICULTURIST:
JOURNAL OF THE
CEYLON AGRICULTURAL SOCIETY.

VOL. XLII. COLOMBO, MAY, 1914. **No. 5.**

RHINOCEROS BEETLE TRAPS.

Peradeniya, May 1914.

The most ubiquitous pest with which the coconut planting industry is plagued is unquestionably the Rhinoceros Beetle which we believe pervades plantations wherever the palm is cultivated. These beetles breed in dead and decaying wood and vegetable refuse for which reason planters are prohibited in some countries from allowing dead wood to lie about their plantations; a somewhat clumsy regulation difficult to enforce. This habit of the beetle places in the hand of the planter effectual weapons of destruction in what are known as beetle traps, worthy we think of close attention. The traps are inexpensive and easily made. A hole 4 feet square and 4 inches deep is dug and into this, round the sides, are placed 4 pieces of coconut stem on which others are built so as to form a wall about 14 inches high. Bricks or stones are preferable to coconut stems as they do not harbour the grub. This enclosure is then filled with small pieces of dead and decaying coconut stems, leaves, plantain stems, farmyard manure; to which may be added, if available, decaying cocoa pods, well dried so as not to generate heat. The mixture should be covered with a thin layer of soil which should be watered from time to time, and the trap cove ed with palm leaves to keep it damp. The traps which could be used as refuse pits of the plantation may be placed about 100 yards apart, open areas being chosen for the sites.

In December last two traps were made at the Peradeniya Experiment Station and these were opened four months afterwards, namely in April, and each found to contain about 100 larvæ of the rhinoceros beetle. Traps were also set at the Experiment Station Maha-iluppalama capturing 150 each. The larvæ may be destroyed by carbon bi-sulphide which is poured into holes made with a crowbar. Probably the cheapest way to kill the larvæ where labour is inexpensive is by hand.

DR. FRIEDERICHS, Plant Pathologist and Zoologist of the Government of Samoa, who recently arrived at Peradeniya, has stimulated interest in the subject by eason of his discovery that by the aid of these traps he can also determine and collect the natural enemies of the beetle among which he finds a fungus which destroys the larvæ. He is visiting Ceylon with the object of studying the Rhinoceros Beetle and collecting if possible its natural enemies found here.

It should not be supposed that the setting of traps is all that is necessary. In a clean plantation subject to very little attack they may be superfluous, though our experience at Peradeniya and Maha-iluppalama, both clean plantations but near jungle, seems to show that they might probably always be usefully employed. Their chief value, however, is as a supplementary measure to clear a plantation of beetles where they are numerous; the first important step in such a case being to clean up the land of dead trunks and refuse vegetable matter. If traps are then added the effects might certainly be expected to be more rapid and complete.

The traps should be opened in two months' time for the destruction of the larvæ. If left longer there would be a danger of their becoming merely breeding grounds propagating the evil they were intended to destroy. The work of opening the traps should therefore be organised under systematic and intelligent control.

R. N. L

C. A. S. YEAR BOOK 1913-1914.

Having a few copies in hand unsold, the Secretary will be glad to let members of the Society have copies on their sending cost of postage—10 cents.

2. Application accompanied by postage stamps should be sent to the Secretary, Peradeniya. It must be remembered that each member can receive only *one* copy. Those requiring more than one can have them at 50 cents per copy.

C. DRIEBERG,
Secretary, C. A. S.

1st May, 1914.

ELEMENTARY TROPICAL AGRICULTURE.

It is recognised that the development of agriculture in West Africa depends not so much on the establishment of plantations under European management as on the adoption of agriculture as a profession by the educated native. In furtherance of this end, MR. W. H. JOHNSON, the Director of Agriculture of Southern Nigeria, has published a book on "ELEMENTARY TROPICAL AGRICULTURE" primarily intended for use in connection with the study of the principles of agriculture in West African schools.

The author has not followed the unsatisfactory practice of "adapting" a book written for some other country, but has made a praiseworthy attempt to produce one which deals with the phenomena and flora of the tropics and is especially suited to the needs of the West African student. This somewhat limits its use, and it is doubtful whether it could be recommended for tropical countries in general.

About three-quarters of the book is devoted to "The Soil and Plant Life," and the remainder to "The School Garden." The latter part, which contains full practical directions for the cultivation of various garden crops will probably be found the more useful. It is curious to find Lantana recommended as a hedge plant.

The first part of the book consists chiefly of elementary botany, with chapters on the soil, insect pests, and diseases. Practical applications are made whenever possible, and great care has been taken to select illustrative examples which are easily accessible in the country. The sections which deal with budding and grafting show a more practical knowledge than is usually found in books on tropical horticulture. No doubt grafting in the Tropics is attended with greater difficulties than in temperate regions, but horticulturists in general have shown a remarkable reluctance to attempt to overcome them. It would seem probable, however, that the author has not carried out experiments in the Tropics with the grafting wax which he recommends.

As is now the usual practice, instructions are given for the performance of experiments in support of the fundamental facts of plant physiology, etc. This is a subject which is beset with pitfalls for the inexperienced. The material for such experiments requires to be carefully selected, if the experiment is to be successful, and general instructions which do not specify a particular plant only lead to disappointment and distrust. In the present case, the instructions are as a rule too general, some of the experiments do not prove what they are said to prove, and many are merely "book experiments" i.e., they are quite unworkable.

From a pedagogic standpoint, the book would have been improved by a revision at the hands of someone actually engaged in teaching. It is difficult, at times, to understand for whom the book was written, as sentences which are obviously intended for the instruction of elementary students are interwoven with others which are equally certainly directions to the teacher. And the same reviser might with advantage have effected improvements in the loose style indulged in by the author.

T. P.

COCONUTS.

MORE ABOUT COCONUTS.

In the overwhelming flood of literature about coconuts, it is a relief to find a book which opens up new ground. "Die Kokospalme und ihre Kultur" by P. Preuss does indeed draw to some extent on Ferguson's well-known Coconut Planters' Manual and other sources; but it contains, in addition, a large volume of new information, the result of personal experience in German Colonies, more especially the Bismarck Archipelago. Moreover, as one would expect from the author's nationality, the information is systematically arranged. The illustrations, chiefly obtained in the Bismarck Archipelago, are generally to the point, and those of coconut beetles will be revelation to most writers on coconuts. One might take exception to the figure of the female flower of the coconut, which might have been drawn from memory,—and not a good memory either.

On the whole, the book is the best which has yet appeared. It is written for the planter, not for the "investor," and the German planter will find it extremely useful. One may be permitted to regret that it will be inaccessible to most British planters. We have searched in vain for any estimate of the cost and profits of a coconut plantation. The author's views—and it must be borne in mind that he has had a wide and prolonged experience of the Tropics,—are expressed in the following terms:—"No return is to be expected before the end of the seventh year, and only under favourable conditions will the expenditure and income balance in the tenth year. Profit begins at about twelve years; and a coconut plantation, fifteen years old, in full bearing, is one of the best and safest of investments in tropical agriculture."

(2) The second book we have to notice, "Coconut Cultivation" by Messrs. Coghlan and Hinchley, is of quite a different character, and may be classed with those which set out to picture coconut planting as the new El Dorado. "The aim of the author (? which) is to interest (planters) more deeply in the cultivation without wearying them by excessive quotations from other writers, or by voluminous statistics in regard to market prices." To avoid wearying them, the authors at first confined themselves to 103 pages dealing chiefly with conditions in Malaya, but having subsequently visited the West Indies, surveyed that region in an additional 21 pages. As the amount of print in each page only occupies a space of 3 × 4½ inches, it will be evident that the information afforded is not voluminous,—indeed if the irrelevant matter be excluded, it is extraordinarily little.

Of the 124 pages, the first sixteen are taken up by two letters written by "the author" to a financial paper, extolling coconuts as an investment, and showing in five years (the 6th to the 10th), from an estate of 500 acres, a net profit of £13,080 on an invested capital of £12,000. The estimated dividends range from 8 per cent. in the sixth year to 27½ in the 10th. Next follow five pages on soils, three of which are extracts from other authors

which will not be of any use to the coconut planter. Chapters 2 and 3 cover twelve pages and deal with the whole art of coconut planting. Chapter 4, on Pests, contains twelve pages, but dismissed fungus diseases in four lines. Chapters 5 and 6, nine pages, deal with the management of the crop and the preparation of copra and coir. These are followed by 29 pages, chiefly voluminous estimates, and 11 pages on Robusta Coffee, extracted from the well-known F. M. S. bulletin on that subject. An appendix consists of 11 pages of tables of various degrees of relevancy, and the 21 pages of information gleaned in the West Indies, of which four are again estimates.

According to the authors, half the present yield of coconuts goes back into the ground as seed nuts ; Malaya is an ideal land for coconut cultivation, because of, *inter alia*, its ozone laden breezes ; the best coconuts are of course grown in Malaya ; Indigo is a paying catch crop ; in late years the shade created by the trees (48 to the acre) keeps in check all weed growth ; the age of a tree is decided by the number of scar rings, which appear on the stem at the rate of two per annum ; tapping the tree for toddy should not be continued for more than a year, and "a considerable period should then be allowed to elapse before again treating or tapping the young shoot of the tree for this purpose," and so on.

The estimated cost of a day's work of "copra mill, oil mill, and fibre mill" dealing with 50,000 nuts per day is given as £403 0*s.* 2*d.* and the net profit as "£79 9*s.* 10*d.* per working day, or over £23,000 per annum." "In the above estimates three-hundred working days are assumed as being one year, so that the profit is practically 100 per cent. per annum on the actual cost of the plant and buildings." One begins to understand why the authors included tables of yields and profits on rubber estates, and the weight of a cubic foot of gold.

Among the points which the authors learnt in the West Indies are (1) that nuts should be stored after plucking, and (2) that the pluckers should not cut notches in the stem to climb the tree.

The authors have been singularly unfortunate in their choice of illustrations. The palm on the cover is certainly not a coconut palm, and the drawings of the inflorescence which form the frontispiece are caricatures. The lowest figure shows a nut one month old, another about two months old, and two others about six months old, on the same inflorescence !

The book might with advantage have been improved by quotations, excessive or otherwise, from other writers, referring to coconuts.

(3) "ALL ABOUT COCONUTS" by MESSRS. ROLAND BELFORT and A. J. HOYER is another "boom book," but the authors (or publishers) have taken more than ordinary care to put it forward in an attractive guise. The book is well printed, well bound, and easy to handle. The coloured paper outer wrapper is too good to be discarded, and the illustrations are, from a technical standpoint, excellent. Indeed it seems a pity to waste such excellent workmanship on such (in some cases) trivial photographs. The publisher may certainly be proud of his production.

With regard to the illustrations—the majority are from (technically) very good photographs ; but the "seed nut after germination" is a "fake," the "copra" photograph is not copra, and the drawings of the rhinoceros

beetle have not a remote resemblance to the actual insect and larva. The palms in the illustration entitled "Coconut palms vigorous at 60" are really about 20 years old, the authors adhering to the fallacy that two leaf scars are produced per annum.

In a book of this description, the estimates constitute the important feature. SIR WILLIAM LEVER is quoted as stating that about £2,000 spent in developing an estate of 200 acres will ensure an income of £2,000 per annum. BROWN's estimate that the cost per acre (500 acres) up to the sixth year, after which the estate becomes self-supporting, works out approximately at £14 5*s*. per acre is cited, with the proviso that the cost may be reduced by catch crops. Some Ceylon people already know the value of this estimate. As "a complete contrast to this estimate and showing what the Germans are doing in the Coconut industry which they are exploiting with their characteristic thoroughness," figures are given for an estate of 1,250 acres in Micronesia which work out at an all-in total cost for the first six years of less than £3 per acre. After this, the West African estimate of £10 per acre for the first six years appears unduly large, and the authors naturally stigmatise as ultra-conservative the estimate in FERGUSON's Coconut Manual (sic) of about £30 per acre for the first 10 years.

The following extracts will illustrate the character of the information and probably interest the Ceylon reader. "Each native consumes about sixty coconuts a month." "In Ceylon alone, over £4,000,000 is thrown away each year by the neglect of the husk." "The green husk makes a toothsome preserve." "The stump produces a juice called toddy: the natives to obtain it make an incision in the stump and beat it until the juice flows. This ferments rapidly until it is transformed into palm wine. The juice contains a strong intoxicant called arrack, and native bakers use it instead of yeast." "The milk which is now practically wasted could and should be utilised for making vinegar, and it is probable that arrangements will ultimately be made for pooling the output of adjacent plantations for this purpose." Ceylon "still imports annually considerable quantities of Indian and Malabar coconuts, besides thousands of cwts. of jaggery, Indian copra, poonac, and coir fibre." "The coconut palm is indigenous to the West Coast of Africa." "Scientific fertilisation, in plain English, means the return to the soil of those vital constituents which former cultivation has absorbed." "Continuous aspiration is accompanied by constant transpiration."

The authors' ideas on the history of rubber cultivation are quite wide of the mark. "There is every opportunity at the moment of dealing with the native planter on lines similar to those adopted a few years ago by British experts in dealing with native rubber planters. Then, as everybody knows, small and scattered ownership was replaced by the formation of vast estates," etc. But rubber plantations were not formed in that way, nor will coconut plantations be. Coconut estates owned by native planters are not the neglected wastes which the authors appear to imagine—at least, not in Ceylon. The chapter on the sterilisation of copra is based chiefly on a misapprehension of the meaning of sterilisation. Sterilisation cannot protect copra from the *subsequent* attacks of insects and fungi, unless the copra is kept in hermetically sealed tins!

T. P.

THE RAT AS A COCONUT PEST.

H. C. PRATT.

The position of priority as a really serious pest to young coconuts in the Malay States must be given to rats. They have caused immense damage in several districts, completely destroying as much as 2,000 acres in one locality. They are not constant in their attack. At certain times of the year they invade young fields in immense numbers and working at night nibble the base of the trees, eventually eating out the heart, leaving a hole about 2½ inches in diameter. The young plant naturally dies. Several remedies were tried and that which is most satisfactory is the protection of each individual tree. Originally the expense of this method was its one drawback. With kerosene tins it would cost $17 per acre. With sheets of zinc the cost was reduced to about $12 per acre. Several designs were tried in order to reduce the cost and it is now possible to prevent the ravages of this destructive animal at a total cost of $5 per acre. Considering the immense damage which rats cause this may be regarded as a nominal cost, although it may be possible still further to reduce it. All estates having young coconuts, i.e., those recently planted out, and where rats have previously demonstrated their ability to devastate large tracts of land, should as a matter of insurance be prepared to spend this amount on protecting their recently-planted areas. It is quite apparent that non-protected areas in some districts are very liable to be destroyed and should this happen the loss involved includes the following:—

1 year lost	1 year's weeding
Re-lining	Re-planting

Purchase of Nuts.

The following method for the protection of young trees will prove satisfactory. Out of a piece of zinc 18 inches long and 12 inches wide an arch is cut at the middle of the longer edge, measuring approximately 7 inches wide at the base, and 5 inches high.

The nut itself fits into this arch and by drawing the tin round the tree a cylinder about 5 inches in diameter is formed enclosing the young tree which practically fills the cylinder. The base of the cylinder on either side of the arch is buried about 3 inches in the ground thus enabling the top of the arch to fit tightly over the upper part of the nut. No rat can harm a young plant protected in this way, for if access is obtained by burrowing there is no room for the rat to work within the enclosure.

Older trees can be dealt with more easily and by the cheaper system of attaching a ring of tin to the trunk with the upper edge turned down. It would not be feasible, on account of expense to enclose older trees. Although it is probable that where the rats are in excessive numbers no trees would be really immune there can be no doubt that it is the younger ones, in fact those recently planted, that require guards. After they are a year old they are not at present often damaged and the guards above described will protect hem for this necessary period.—F. M. S. Bulletin.

PRODUCTS OF THE COCONUT PALM.

The following figures from the Report of the Ceylon Chamber of Commerce for the half year ended 31st December, 1913, show the exports from Ceylon for 1913 as compared with those for 1912:—

		1913.		1912.	
Coconut Oil	...	545,750	cwt.	395,740	cwt.
Copra	...	1,154,121	,,	628,529	,,
Desiccated Coconut	...	34,334,759	lbs.	31,295,813	lbs.
Coconut Poonac	...	239,968	cwt.	169,019	cwt.
Coconuts	...	16,858,007	nuts.	15,983,749	nuts.

COCONUT PLANTING.

A PROFITABLE ENTERPRISE.

During the past few years the constantly-rising price of the products of the coconut palm has not only attracted the attention of tropical planters engaged in the production of the nuts and manufacturers in Europe and America who employ coconut-oil, or coir in their industries, but also interested financiers desirous of finding new outlets for capital.

The advance in prices has been phenomenal. A very few years ago copra—that is, dried kernels of the coconut from which the oil is obtained—could be bought at from £10 to £12 per ton. The market quotations yesterday for the same article were from £30 15*s.* to £32 18*s.* 9*d.* per ton, an increase of nearly 300 per cent. in about ten years. The causes of this remarkable inflation are not far to seek. It is simply due to the fact that the production of coconuts is insufficient to keep pace with the world's demands. Coconut oil has long been in use for the manufacture of soap, candles, lubricants and articles of that kind. The inhabitants of the tropical countries have always used the nut as an important food, but the supply, on the whole, was fully equal to the demand, and prices for a long period remained at about £10 or £12 per ton.

But in recent years the supply of animal oils and fats which form an essential ingredient in the dietary of all peoples began to be inadequate to meet the world's consumption. Chemists and manufacturers began to search for substitutes. Their attention was turned to the oil of the coconut, and presently a method was discovered of removing the peculiar flavour which rendered this substance unpalatable to European peoples, and at the same time a means was found of overcoming its liability to become sour and rancid when kept for any length of time. These discoveries, which are to be credited to the investigations of Continental chemists, at once opened up a new and very extensive field for the use of coconut oil. It became possible to employ it in the manufacture of artificial butter, or margarine, to use it in pharmaceutical preparations, and in a great variety of other ways in which hitherto animal oils and fats have alone been utilised. Much of the salad oil which now comes on the dining-table is derived from the coconut ; it is used to an enormous extent in cookery, and huge quantities go to the manufacture

of the white inner core of the chocolate "creams" that young and old find so delicious. Naturally enough, these fresh applications of this wholesome and easily digestible vegetable oil created an increased demand, and prices began to go up until they have now reached a figure three times as high as that of ten years ago.

COPRA CONSUMED.

The quantity of copra consumed at present in the preparation of comestibles is stupendous. One English firm engaged in the manufacture of so-called "nut-butter," which is constantly increasing in public favour as it becomes known, requires 500 tons daily to enable it to supply the demand. Half-a-dozen years ago the same firm did not use an ounce of copra, while to-day it consumes 150,000 tons annually. The value of coconut products exported for the present year is estimated at £750,000,000. This is £25,000,000 more than the value of the world's total output of rubber, and is not far behind the gold produced by the world's mines which is estimated at about £100,000,000. Yet the export represents only about one-fifth the total value of the coconut crop.

The profits to be made from coconut plantations are very great, but there is no prospect of production overtaking the demand, however great may be the effort to exploit the industry. The amount of land suitable for the crop is strictly limited. The coconut palm is a strictly tropical plant, and the fact that it will only thrive to perfection in sandy soil, near the sea, within a belt about 500 miles wide on each side of the Equator, renders it improbable that any excessive area can ever be cultivated. The countries where the palm will grow are the following which are placed in order of suitability of soil, climate, and other conditions: Malabar, West Africa, Dutch East Indies, Ceylon, East Africa, Malaya, Papua, and the West Indies. From the time of planting until the trees come into bearing is about seven years, but after that period the value of a plantation increases until it becomes a veritable gold mine. A good plantation in full bearing, that is, from the time the trees are about twelve or fifteen years old onwards, for nearly 100 years, will produce an annual net income of £10 per acre. An estate of 2,000 acres would, therefore, produce a very large revenue. The cost of bringing a property of this extent into full development is estimated at about £20,000 or the equivalent of one year's income.

These new applications, as already mentioned, have increased the demand for copra to an enormous extent. The whole of the Tropics is being ransacked for coconuts, and enough cannot be found, though the world's produce is estimated at about eight thousand million nuts. According to the views of those interested in the copra trade, a coconut famine is bound to arrive in a year or two. The price to which copra is almost certain to rise will no doubt lead to a great development of planting, and we shall probably see a "boom" in coconut plantations similar to that which occurred a few years ago in connection with rubber. Like the rubber tree, the coconut-palm requires a considerable time before it begins to produce a crop. These years, while they may be very lean for the manufacturers and consumers of coconut products, will be fat and prosperous for the fortunate owners of existing plantations.—INDIAN AGRICULTURIST.

COCONUTS IN THE ISLAND OF SAMAR.

Coconuts rank next to abaca in importance. From no export at all previous to 1908 to nearly 7,000 tons of copra exported from the town of Catarman during the year 1913 is some indication of how rapidly this new industry is developing—not to mention the enormous number of nuts used locally for cooking purposes and the trees tapped for tuba.*

More than a million new trees have been set out in the Catarman Valley during the past three years and the people here are just beginning to take a real interest in this product, abaca having heretofore occupied the farmers to the exclusion of all other pursuits.

There are still vast areas of choice coconut land available here at reasonable prices which could be made into beautiful and well-paying groves. With but a few notable exceptions the well-laid-out and well-kept groves are owned by foreigners or enterprising Filipinos from other parts who have seen the opportunity and have settled here to invest their capital. Of foreigners, there are at present twelve Americans, four Spaniards and a number of Chinese engaged in planting coconuts.

There are in evidence here the several varieties of nuts to be found in other coconut-producing provinces, some with yellow reddish husks while still unripe and others of various shades of green. There seems to be small preference as to kind in the matter of meat, one sort giving about as much as another. There is one variety here, however, which is said to be more prolific than the others. The native name of this is "Gugobing" and it is claimed that this variety bears as many as twenty nuts to the fruit stem. The nuts are of large size, thin husk, and a good quality of thick meat.

What is true of abaca as regards seed selection and clean cultivation also applies to coconuts. A well-cared-for grove will yield fruit in its fifth year but those who put a nut in the ground and expect Providence to do the rest, generally wait nearly ten years.—Philippine Agricultural Review.

SWEET POTATO AS A COVER CROP FOR COCONUTS.

G. Schaeffer.

During a visit to the Malay States in 1913, the writer saw young coconut plantations in which sweet potatoes were grown as a cover crop on black peaty soils with excellent results.

The advantages of this crop are (1) its rapid growth and spreading habit, giving complete protection to the soil; (2) reduction in expenses of cultivation; (3) natural decay of the plant when the trees reach maturity.—

Monthly Bulletin.

* A native wine

COCONUT BUTTER.

According to the United States consul at Carlsbad (Austria), most of the coconut butter manufactured in Bohemia is made of Cochin or Indian copra, which is received in large wooden tuns. The dried copra is sliced, and the fat is extracted by oil presses—quite a simple process. This raw oil contains soap fats and does not have a pleasant odour. It is placed in large tanks, and the first step in the refining process is the addition of powdered chalk, which absorbs the soap fats and settles to the bottom of the tank. The oil on the surface is pumped into another tank, passing through four or five filters as the second step in the refining process. It is then forced into a tank heated by steam pipes to about 270 to 518 degrees F. This process continues until the oil is as clear as crystal and begins to bubble. It is then pumped into an automatic weighing apparatus and run into the moulds, where it is allowed to cool, the tablets or cubes are removed to the packing table. Part of the oil is run into various sized tubes and is also placed on the market in this form. The soap fats, combined with the chalk, are treated with sulphuric acid, which dissolves the chalk, leaving the fats floating on the surface of the solution. These are drawn off into tubes and are sold to manufacturers of soap. The trimmings of the copra slices are made into a powder, which commands a good price as fodder for cattle and pigs. The coconut fat is white, but when manufactured into butter is coloured to resemble oleomargarine. Sesame oil is added to make the product more pliant. Coconut butter keeps well either raw or refined, and does not spoil for months, even in warm weather. It is claimed that the ordinary consumer cannot detect the difference between this butter and oleomargarine. Six or seven years ago the output of coconut butter in Austria was about 40 tons a day. It is now approximately 300 tons. The price has increased from 18·25 dollars (£3. 15*s*) to 26 dollars (£5. 8*s*. 6*d*) for 200 lb. The factories claim that they cannot keep up with the demand. The market is controlled practically by two firms—one in Vienna, the other in Aussig.—

Queensland Agric. Journal.

CANNED PINE-APPLE.

Canned Pine-apple, familiar to us either as Pine Chunks or Cubes, or as whole Pines, has come to us mostly from Singapore, although in recent years the "Hawaiian" variety has made its mark on this market. Still, however, the great demand is for pine-apple chunks, and in selecting these one should see that the chunks are quite ripe, of a rich golden colour, whilst the fruit should be quite firm and not spongy. The pine-apple should, of course, run quite level in colour throughout the tin, but the packers, of late years, in this industry seem to have grown careless and large quantities of half-ripe fruit have been packed. The "Hawaiian" Pine Slices seem to represent the last word in pine-apple canning, and are justly popular on account of their extremely delicate flavour.—Grocers' Journal.

CACAO.

FERMENTATION OF CACAO.

ARTHUR W. KNAPP, B. SC., LOND.

I was sent to Trinidad by MESSRS. CADBURY BROS., LTD., chiefly for my health's sake. Whilst there, through the kindness of various planters, I was able to observe the methods of fermentation on some twenty plantations, and in some cases I was permitted to carry out experiments. In the notes which follow I restrict myself to a consideration of the *practice* of fermentation.

On the whole Trinidad cacao is well fermented, and the only reason that more care is not taken is that the difference in the price obtained locally is not commensurate with the extra trouble. The Trinidad broker appears to judge largely by the external appearance, so one finds some capable scientific planters satisfied with the sweat-box they found on their plantation, and not even attempting to separate the diseased and germinated beans, but instead claying up to the right appearance. Too much attention is given to making cacao look right. It would be an advantage to manufacturers if they could encourage more attention being given to the real internal quality of the bean. I should have thought that it would have been an advantage in Trinidad for an association of planters to fix a standard which prohibited the presence of unfermented, diseased, germinated, or grubby beans, and to have all bags of beans passing this standard suitably marked. The effect of putting on the market large consignments of an equally high quality would be sure to enhance the price on the London market.

WHY FERMENT?

The following is a brief comparison of fermented beans compared with beans dried direct in the sun:—

	Dried beans.	Fermented beans.
Shape	Flat	Plumper or rounder.
Shell	Soft	Crisp, usually darker outside; note the dark-brown colouring deposited on inside of shell.
Looseness of shell	Shell tight	Shell more or less free.
Colour of interior	Mud or slate-colour to black.	Bright; light and dark browns (and purples).
Consistence of interior	Leather to cheese.	Brittle; crumbles readily.

The above shows the extreme differences. In practice the dried beans are generally slightly fermented.

When dried unfermented beans are roasted the product is inferior to the roasted fermented bean in all respects. It is very different from cacao, having a herbal odour, a grey colour, and a rather astringent taste. It will be seen from this how desirable it is that beans should be fermented. However, the planter may object that, whilst there is a gain in quality, there is a loss in weight as compared with drying. Beans which are fermented are said to be lighter than those which are merely dried. Now the beans lose certain constituents, but they gain oxygen.

In an attempt I made on a small scale, selected Criollo pods from one tree were taken and the beans mixed, and half put in a muslin bag. This bag was put in the midst of the beans in the sweat-box, and the contents underwent the usual fermentation. The other half were dried. This experiment was repeated with the beans most unlike Criollo that is, Calabacillo. The results obtained were as follows:—

Pod.	Beans.	Average weight per Bean.	Number per lb.	Shell.	Moisture in shelled beans.	Butter in shelled beans.
		Grms.		Per cent.	Per cent.	Per cent.
Trinidad	Unfermented	1,682	270	17·0	5·02	60·22
Criollo	Fermented	1.716	260	13·3	4·87	54·74
Trinidad	Unfermented	0.893	510	16·1	5·03	53·33
Calabacillo	Fermented	0.854	535	15·1	5·15	50·01

The above results show (1) hat whilst the fermented Criollo beans were 2 per cent. heavier than the dried, the fermented Calabacillo beans were nearly 5 per cent. lighter than the dried: (2) that, contrary to expectations, there was on fermentation a loss of butter in the shelled beans. This butter had not passed into the shell.

Instead of giving a long account of the various types of sweat-boxes that I saw in Trinidad and Grenada, it seemed to me better to condense the results of my observation and experience into a recommendation of what I considered the best type. Whilst the conditions are given for Trinidad, with some modification they should hold for other climates and other types of beans.

The general conditions for good fermentation are that (1) The mass of beans must be kept warm ; (2) the mass of beans must be moist, but not wet; (3) in the later stages there must be sufficient air ; (4) the boxes must be kept clean.

HOW TO OBTAIN A GOOD FERMENTATION.

The Sweat-boxes. Material —This should be hard native wood. Pitch pine is rapidly rendered rotten by insects. In Trinidad cedar and cyp are t ne best native woods for this purpose. As few iron rails as possible should be used (see Appendix B). The floor should be of concrete, smoothed with cement, and the roof may be of corrugated iron.

Position.—The boxes should not be in a very exposed position. It is often convenient to build them under the drying floor.

Construction.—A wooden shed, about 10 feet high, is divided off by movable boards into boxes. The concrete floor of the shed is so shaped that the sweatings run along channels out of the building into a small, covered, cement-lined pit. The boxes should be raised about 6 in. above this floor on uprights, so that the air can circulate freely beneath them. There should be a space of about 4 in. between wall of building and side of box, thus forming a double wall with air space (see Appendix B). The boxes should be 4 feet each way (for reason of this size, see Appendix B), the boards fitting into grooves and being readily removed. The floors of the boxes should be made of boards about 3 in. wide, placed about ¼ in., or less, apart, fastened together by cross-pieces, and the whole grid made removable for cleaning. The roof should hang over about 4 feet to protect the beans from the rains during charging, and the walls from the sun. The shed should be ventilated at the top. A simple method is to remove a 6 in. to 12 in. board from that side and end of the shed which are least exposed to the prevailing winds, and cover the slits with wire-netting. The area of the shed must be such that it will take two 4 ft. x 4 ft. boxes for every 8 cwt. of dry beans that are to be produced per week.—TROPICAL LIFE.

(*To be continued*).

CACAO MANURING EXPERIMENTS.

We have before referred to experiments in manuring cacao as carried on both in Dominica and Trinidad. These show how greatly different conditions may affect results, and although the results of these experiments are interesting to us, we should not look with any certainty for the same results here. For instance, surface mulching with grass and leaves gave the best nett results in Dominica all through, over the application of different combinations of artificial fertilizers, and animal manure dug in. But this is not so in Trinidad. Mulching however happens to be most expensive there, but allowing for this, mulching with grass and leaves has not had the good results there that it had in Dominica or has here. Elaborate tables of the results on different estates in Trinidad are printed in the Bulletin of the Department of Agriculture of Trinidad and Tobago. While the addition of artificial fertilisers in most cases resulted in increased yields, in some cases the Control plots, that is the plots that received no manure, gave better results, that is, more dry cocoa per acre, and even in many of those cases where the application of fertilisers and lime and pen manure gave far better yields than the plots not manured, when the cost of manure was deducted, the nett results on most estates were, that the plots not manured gave more profitable results. Again, the same combination of fertilisers did not give the same results on different estates. We notice for instance that 2 lb. of Basic Slag and ½ a lb. of Sulphate of Potash applied to a plot of 115 bearing trees gave a nett profit on the yield of $20.51 per acre. The plots that received no manure gave $13.91 and $14.71. Whereas on another estate the best nett results from the application of fertilisers over 136 trees was $28,62, while pen manure with the addition fertilisers only gave a nett profit of $3.81 whereas the plots not manured

gave $34.53. There was also this result, that out of these three plots which were not manured, two of the plots being forked, and one not forked. Plot No. 3 forked 3 inches deep, gave a nett profit of $38.12 over 141 trees. Plot No. 7 forked 9 to 12 inches deep, gave a nett profit of $56.59 over 173 trees. Plot No. 9 not forked, gave a nett profit of $70.62.

The best results from fertilisers on this estate were secured from the application of 1½ lb. of Sulphate of Lime, ½ lb. Sulphate of Potash and ¼ lb. Sulphate of Ammonia, over 153 trees from 30 to 40 years old. The nett profit was $58.82, but as has been stated every estate gave different results. In one case 40 lb. to 50 lb. per tree mulching gave the poorest results of all, less than those receiving no manure and no mulch.

This to us is extraordinary, because in almost every case where mulching has been applied here, good results have been obvious, but the rainfall in Trinidad is much heavier on an average than here, and we are not prepared to say that mulching on clay soils, or in a very wet climate is always beneficial. It is beneficial on light and medium soils and in districts where spells of dry weather are regularly to be expected. The printed results are very interesting, but as regards Jamaica they are not in any way conclusive, but they do show that in Trinidad they must have been hitherto groping pretty much in the dark when they applied fertilisers, pen manure and mulch, and forked. We should like to see careful comparative experiments carried through on unpruned trees versus trees intelligently pruned.—Jamaica Agric. Society Journal.

MINIMUM OF PLANT FOOD REQUIRED FOR MAXIMUM PRODUCTION.

W. H. JORDAN.

Experiments were devised with a view to ascertaining the essential minimum amount of available phosphoric acid and potash required to produce maximum growth. The crops used included barely, peas, tomatoes, tobacco, buckwheat, rape and turnips.

Two sets of cultures contained all the required elements except phosphoric acid and potash respectively, one of these elements being added in progressive quantities to the several cultures of each set. The conditions of temperature and moisture were under control and were as far as possible regulated so as to fully satisfy the requirements of the plants throughout the experiments. The results obtained show considerable uniformity amongst the different crops.

No fixed relation exists between the production of dry matter and the amounts of phosphorus and potash utilised. Up to a somewhat indefinite point the production of plant substance increased in most cases with increase in the supply of the variable constituent, but beyond that point increase in the consumption of both phosphorus and potassium compounds only resulted in an increase in the proportion of phosphorus and potassium in the plant tissues and not to a corresponding increase of plant growth.

The results also confirm, the conclusion that the chemical analysis of a given crop is no certain criterion of the manurial requirements of that particular crop.—Monthly Bulletin.

COTTON.

THE WORLD'S COTTON INDUSTRY.

The average yield of cotton from each country during 1907-10 is given in the following table :—

	Millions of tons.	Percentage of total.	Yield per acre.
United States	2,454	62·2	180 lb.
India	695	17·7	72 ,,
Egypt	292	7·4	410 ,,
Russian Empire	172	4·3	—
China	132	3·4	
Brazil	76	1·9	—
Peru	22		—
Mexico	26		—
Turkey	16	3·1	—
Persia	15		—
Other Countries	42		—
Total	3,942		

The value of the world's total production of cotton is about 250 millions sterling. The most important producing country is North America, but further development is hindered by unsuitable climatic conditions in the west and South and the scarcity and dearness of labour, the latter being an almost insuperable difficulty. Further development in Egypt is also improbable except in the higher regions, which will only produce inferior varieties of cotton.

Besides, these countries have reached their highest yield per acre. In 1901-02 the yield per acre in Egypt was 460 lb. per acre, while in the years 1908-10 it had fallen to 370 lb.

The ideal conditions required for successful cotton cultivation are (a) a soil with abundant moisture ; (b) a low rainfall ; (c) abundant sunshine ; (d) a humid atmosphere, and (e) an abundant supply of labour. These conditions are to be found in Asia, particularly in India, Turkestan and Mesopotamia, and it is in these countries that future developments in the cultivation of cotton will take place. Some parts of Nigeria abundantly supplied by the Niger also offer great possibilities of development in this direction, almost equal to those of Mesopotamia.—MONTHLY BULLETIN.

THE COTTONS OF CULTIVATION.

CARL GELLER.

The cotton production of the world may for industrial purposes be divided into two classes—cotton having a length of fibre up to about 1 1/16th inches and that of longer staple. The first-class embraces 90 per cent. of the total production and includes ordinary American Upland, Mexican, East Indian, Russian, Chinese and Turkish cottons. It is spun into coarse and medium yarns up to about 60s., which go into the great bulk of cotton manufactures for wearing apparel, household and industrial uses. It can be grown in all parts of the world where winter is not protracted, as cotton requires six or seven months of good growing weather. There must be a fair amount of moisture, either as rainfall of at least 30 inches, but not exceeding 70 inches a year, fairly evenly distributed, or supplied by irrigation ; and the mean temperature during the four or five chief growing months must be from 70 to 80 degrees. As these conditions obtain over a wide area of the world's surface, the capabilities of producing ordinary cotton of the "bread and butter" variety are practically unlimited. This country alone could increase its cotton acreage from the present figure of 37½ million acres to 120 million acres without encroaching on the acreage of other agricultural products.

The remaining 10 per cent. of production embraces American Sea Island, American long staple Upland, Egyptian, Peruvian, Brazilian and West Indian cotton, also small quantities of Turkish, Chinese and Sudan cotton and American cotton grown from Egyptian seed. This class commands a large premium in price, because of its restricted production and its special character, which makes it suitable for purposes where strength and fineness are indispensable. Its special character is either due to climatic influences, to seed selection, or both. Long staple cottons are used for spinning fine yarns for making sewing thread, automobile tire linings, mercerized yarns, "silk" goods and for mixing with wool.

SEA ISLAND COTTON.

Only about 15 per cent. of this cotton is really raised on the islands along and the mainland near the South Carolina coast. The remainder is produced in a narrow belt extending from North Florida through South-east Georgia, South Carolina. S.I. cotton constitutes the cream of the entire cotton yield of the world, as its staple attains a maximum length of 2 1/5 inches and can be spun into yarn as fine as 400s and 500s. Comparing with to-day's price of 13 cents for middling Upland cotton, fine South Carolina S.I. costs 21 cents and extra fine about 50 cents per pound. Florida and Georgia S.I. cotton has a maximum length of 1⅞ inches and is suitable for spinning yarns from 150s. to 300s. Its present price varies from 17 cents for common to 21½ cents for fancy. In 1911-12 the total S.I. cotton production of this country reached 123,000 bales of 400 pounds each, but this proved temporarily in excess of the demand, and as at the same time a new Egyptian variety closely resembling medium S.I. came upon the market, prices became unremunerative and in 1912 the acreage was much curtailed. Production was cut in half, and even the present crop does not promise to yield more than 70,000 bales. Present prices in Liverpool are 2 to 3*d*. per lb. below those of last year and 1½ to 3*d*. below those of two years ago, despite the greatly reduced supply.

The apathy of the S.I. cotton grower is further increased by the fact that his fields will soon have to pass through the ordeal of the boll weevil invasion. In view of the length of time required to mature S.I. cotton, it is feared that the ravages of the insect will be disastrous and many farmers will abandon the cultivation of the slow growing S.I. variety, planting in its stead early maturing Upland cotton.

Outside of the United States some S.I. cotton is grown in the West Indies, on the Peruvian coast and in Tahiti. To bring out the chief features of S.I. cotton—length and silkiness of the fibre—it has to be grown near the sea. If grown inland these characteristics soon disappear and it becomes necessary to obtain fresh planting seed from South Carolina.

AMERICAN LONG STAPLE COTTON.

Until the advent of the boll weevil this variety was chiefly produced from selected seed in a strip of country about 75 miles wide and 200 miles long lying in the Mississippi Valley, between Memphis and Vicksburg. Since the appearance of this insect many farmers have abandoned the cultivation of this long staple cotton, which requires a long time to mature and is thus specially exposed to its devastating attacks. The United States Government is making praiseworthy efforts to introduce types of prolific big boll cotton of $1\frac{1}{4}$ to $1\frac{1}{2}$ inch staple and possessing the essential early maturity. Such long staple American cottons are now grown in California and Arizona, in various localities of Texas, in the Red River Valley, in sections of Alabama and also in South Carolina. Very probably with the passing of the boll weevil scare in Mississippi, the "Delta" will also revert to the growing of long staple varieties when prices become tempting again. It is difficult to estimate the total production of long staple cotton in this country. Some experts do not think that at present it exceeds a total of 30,000 to 40,000 bales. Due to strong competition of some Egyptian varieties prices are not as remunerative as they used to be. Compared with 13 cents for middling Upland, long staples bring 14 to 17 cents per pound, whereas in previous years premiums of 8 to 10 cents were not uncommon.

EGYPTIAN COTTON.

This cotton is grown in the Nile Valley, over an area of about 1,750,000 acres, of which, 1,350,000 are north of Cairo and 400,000 South of the Egyptian capital. Egypt being practically a rainless country, cotton cultivation is almost entirely dependent upon irrigation fed by the annual rise of the Nile. In order to obtain a uniform water supply a huge dam has been built across the Nile at Assuan, but while this removes the danger of insufficient Nile floods, the abundant supply so provided has led to water-logging of the soil, and the hope of vastly increased crops of Egyptian cotton has so far not been fulfilled. Before the completion of the Assuan dam the Egyptian cotton crop had several times reached $6\frac{1}{2}$ million cantars (one cantar equals 99·05 pounds), but long after the building of the dam and with abundant water supply the crop fell in 1909-10 as low as 5 million cantars. At one time the present crop bid fair to exceed 8 million, but a new insect pest, the pink boll worm, has caused much damage, and not more than $7\frac{1}{4}$ million cantars are expected of this crop. The following are the chief Egyptian varieties :—Ashmouni—strong, brown, silky, mean length of staple $1\frac{1}{4}$ inches, used for balbriggan underwear and yarns to about 80s ; Afifi,

Nubari and Assili—brown, lustrous, strong, fine, used for yarns up to 100s and brilliant surfaced goods; Abassi—$1\frac{1}{4}$ inches, pearly white, used for sewing silk; Janovitch—$1\frac{1}{2}$ inches, fine, strong, silky; Gallini—$1\frac{1}{2}$ inches, strong, bright golden; Sakellaridis—$1\frac{1}{2}$ to $1\frac{3}{4}$ inches, a recent variety, lustrous, white and strong, closely competing with the medium grades of American Sea Island.

Of the 1,750,000 acres under cotton last year about 800,000 were devoted to Afifi, Nubari and Assili; 45,000 to Abassi, 225,000 to Janovitch, 350,000 to Ashmouni and 260,000 to Sakellaridis. It is worthy of note that while in the United States the average cotton production per acre is only about 200 pounds of lint cotton, in Egypt, under the intense cultivation prevailing there, it rises to about 450 pounds per acre. Comparing with the present Liverpool price of 7*d.* for middling Upland, American cotton, the Egyptian varieties in good, fair quality are quoted as follows:—Ashmouni, $9\frac{3}{4}d.$; Abassi and Nubari, 10*d.*; Sakellaridis, $10\frac{1}{2}d.$, and Janovitch, 11*d.*

PERUVIAN COTTON.

There are three kinds of cotton produced in Peru—Upland, Rough and Sea Island. The staple of these three varieties is $1\frac{1}{8}$ to $1\frac{3}{8}$ inches. Rough Peruvian has a fibre of $1\frac{1}{4}$ inches and is kinky, closely resembling wool, which makes it specially suitable for mixing with that material. The Upland variety is smooth and white, about $1\frac{1}{4}$ inches long and in good demand. Most of it is produced along the coast, north and south of Lima. Some cotton is grown there from Afifi (Egyptian) seed also from Sea Island seed, and good results are obtained. The great drawback to the development of cotton cultivation in Peru is the lack of irrigation works. The total crop amounts to 140,000 bales, of which one-third is of the "rough" variety largely exported to the United States. Comparing with the Liverpool price of 7*d.* for middling Upland American cotton, good rough Peruvian, is quoted at 9*d.*, smooth Peruvian at 8*d.*, Peruvian Sea Island and Afifi at $10\frac{1}{2}d.$

BRAZILIAN COTTON.

Two kinds are grown, tree cotton and herbaceous cotton. The principal cotton section is in the North-Eastern Brazil. The staple varies from 1 to $1\frac{1}{4}$ inches, and in Liverpool commands a premium of $\frac{1}{2}d.$ over similar American varieties. The production is about 375,000 bales, of which half is consumed by Brazilian mills and the balance goes chiefly to Liverpool. While the area suitable for cotton cultivation is immense, labour is scarce and the main drawback is the uncertain and irregular rainfall, for notwithstanding the heavy rains on the Atlantic coast, the inland section, where most of the Brazilian cotton is raised, has frequently to contend with prolonged drought.

Other long staple cottons are raised in Asiatic Turkey (Smyrna), Sudan (Nubari and Afifi Egyptian), Tahiti (Sea Island) and China (Yangtze Valley, from American seed), but the quantities are so far small.

We thus find that the cultivation of low grade, ordinary and short staple cotton may be expanded almost indefinitely, but that at present at least the cultivation of fine long staple sorts is restricted—in this country by unremunerative prices and the boll weevil; in Egypt by the pink boll worm and inability to cope with the new condition of the soil brought about by the irrigation works, and in Peru and Brazil by lack of labour and inadequate irrigation. Beyond any doubt, should sufficient inducement be offered by high prices, the production of long staple cottons could be greatly increased, and steps in this direction are taken by the Governments of the principal cotton-growing countries.—India Rubber World.

SISAL HEMP.

A good deal of interest has been excited over the articles on Sisal Hemp published in the Journal and enquiry has been made as to specific differences beeween the variety cultivated in Yucatan usually called Henequen and the real Sisal, the plants of which are more common here and which is the variety cultivated in the Bahama Islands. Both have their advantages.

We take the following from a Bulletin of the United States Department of Agriculture : Plants of both varieties can be got here in some quantity.

HENEQUEN.

The largest quantity of binder twine is made of fibre obtained from the leaves of the Henequen plant (Agave fourcroydes). This fibre is commonly known in the trade as "Sisal," because it was formerly shipped from the port of Sisal in Yucatan, but it is different from the fibre of the true Sisal plant. Henequen is native in South Eastern Mexico, and it is cultivated in Yucatan and Campeche and to a limited extent in the States of Chiapas, Sinaloa, and Tamaulipas, Mexico, and also in Cuba. It is rarely seen outside of these regions. It requires a hot, dry climate and well-drained limestone soil. In Yucatan, where it thrives best, the lowest recorded temperature is 48° F., and the annual rainfall is about 30 inches. The atmosphere is very dry, except when it is actually raining, and the porous limestone soil affords excellent drainage. This soil also permits free access of air to the roots, which is necessary for the best development of Henequen.

Henequen plants produce seeds and bulbils, but they are propagated chiefly by suckers which grow from the root stocks. The suckers are set out in rows about 9 feet apart and about 6 feet apart in the row. The vegetation between the plants is kept down usually by cutting with machetes. Better results are obtained by clean cultivation where the land is not too stony.

The first crop of leaves is cut 4 to 7 years after planting, usually the sixth or seventh year in Yucatan, and after that annual or semi-annual crops are cut for 10 to 20 years. Only the two outer or lower rows of leaves are cut at each harvest, leaving the others to develop. The spines on the point and margins are trimmed off and the leaves are tied in bundles of 50 each and taken to the cleaning machines. Nearly all of the Henequen fibre of commerce is cleaned by machinery within 48 hours after the leaves are cut.

SISAL.

The true sisal fibre is obtained from the leaves of the sisal plant (Agave sisalana). This plant is native in Southern Mexico and Central America. It is cultivated for fibre production in the Bahamas, Hawaii, German East Africa, and on a few plantations in India and in Chiapas, Mexico ; but in Yucatan it is cultivated to only a small extent for the production of fibre for domestic use. It is more widely distributed in gardens and collections of economic plants than any other fibre-producing Agave. It is often incorrectly labelled "Agave rigida sisalana." It will endure slight frosts and a considerable variation in soil and moisture better than Henequen, but for profitable fibre production it should be cultivated only in dry limestone soils in regions where the temperature does not fall below freezing.

Sisal produces suckers and bulbils, as does Henequen, but no seeds. The bulbils, and usually the suckers, are cultivated 6 months or more in a nursery before being set out in the field. When 15 to 20 inches high they are transplanted to the field and set out in rows 6 to 9 feet apart. The first crop of leaves is out 3 to 5 years after transplanting, and annual or semi-annual crops are obtained for 4 to 10 years thereafter. Much of the sisal fibre in the Bahamas is cleaned by hand after the leaves have been soaked in water to soften the pulp. This produces a dull-grey or dingy-coloured fibre of poor quality. The best sisal is cleaned by machinery in the same manner as Henequen. When properly cleaned it is clear, ivory white, with a good lustre, and it is stronger than Henequen. Well-cleaned sisal commands a price somewhat better than Henequen, and it can be used to better advantage in higher grades of cordage than binder twine, while the hand-cleaned sisal is too poor to be made into binder twine except for mixing in the lowest grades.

Fibre.	Weight per metre. Grams.	Average breaking strain per strand. Grams.	Breaking strain per gram metre. Grams.
Henequen (Yucatan sisal)			
Agave fourcroydes ...	·05420	1,085	20,021
Sisal (Hawaii & East Africa)			
Agave sisalana ...	·04370	1,472	32,773

—Jamaica Agric. Society Journal.

KAPOK GROWING AS AN INDUSTRY.

Mr. M. Saleeby, Chief of the Fibre Division, United States Department of Agriculture, Manila, in a bulletin (No. 26) on kapok, points out that

THE ANNUAL YIELD

of clean kapok from a tree of normal growth and under 7 years of age may be placed at 350 or 400 pods. Trees between 7 and 10 years should average 600 pods or more. Reckoning that 230 pods produce 1 kilo (about 2 1/5 lb.) of clean fibre; a hectare (about 2¼ acres) containing 280 trees ought to yield 95,000 to 110,000 pods, which, at the rate of 230 pods to 1 kilo (2¼ lb.) will yield 410 to 480 kilos (922 lb. to 1,080 lb.) of clean kapok per year. From the 7th to the 10th year, a hectare (2¼ acres) should produce about 640 kilos (about 1,440 lb.). The clean kapok averages from 55 to 65 per cent. of the weight of the seed. A tree which yields 3 kilos of clean kapok during the year yields also about 6 kilos of seeds. The value of kapok for the highest grades has gradually risen from 27 centavos (13½*d.*) in 1900 to about 80 centavos (3*s.* 4*d.*) in 1907; and in 1912 the value continued to advance, reaching its maximum of 90 centavos (3*s.* 9*d.*) per kilo of 2 1/5 lb. towards the latter part of the year.

THIS GRADUAL RISE

in the value of kapok is accounted for by the continual increases in the uses made of it, which was in turn caused by more general knowledge of its superior qualities and its suitability for several purposes heretofore unknown.—LOURENZ MARQUES GUARDIAN.

ARTIFICIAL RIPENING OF COTTON.

The question of ripening is one of the most important in the cultivation of cotton. An American inventor seems to have found a process for ripening cotton by artificial means, which would allow all the bolls being gathered at one picking. L. DE COSTA WARD, of the Philadelphia Textile School, has tested bolls matured naturally and others artificially by the Hall process. They showed practically the same length of staple in both cases, with the artificially matured fibres possessing greater strength. The seed from the bolls was tested by M. J. WILLIAMS, Government Chemist, who reports that the oil and fat in the artificially ripened seeds was 2·32 per cent. higher than in the naturally ripened ones.—MONTHLY BULLETIN.

PLANTING SWEET POTATOES

TUBERS *v.* VINES.

The Curator of the Botanic Station, Montserrat, has sent in the results of an experiment carried out to test the value of sweet potato cuttings taken from sprouted tubers as compared with cuttings taken from the vines in the ordinary way. It may be mentioned that similar experiments were conducted in Cuba some few years ago and reported on in the AGRICULTURAL NEWS, Vol. vii, p. 120, where it will be found that the plots planted with slips returned a crop three and a half times as great as those planted with cuttings. In this experiment the gain of 350 per cent. fully repaid the extra expense and trouble involved.

In the recent Montserrat trials there has been no such phenomena difference noticed, though the figures show there was, in the case of some varieties, quite a considerable increase in yield from the tuber cuttings compared with the wine cuttings. It is interesting to observe that no difference in vigour was noticed in the rows planted with the two kinds of material.

The following are a few of the yields which seem to be the most striking: Red Bourbon (ordinary vines) 114 lb. (tuber cuttings) 145 lb; White Gilkes (ordinary vines) 83 lb. (tuber cuttings) 111 lb. In no case did the tuber cuttings give a lower yield than the ordinary vines, but it is not established that the average increase is sufficiently large to warrant the systematic planting of tuber cuttings instead of ordinary vines. At the same time the matter is worth serious consideration in the case of one or two special varieties.

It should be stated that as regards the size of the plots utilized in the experiments, the length of the row was 81 feet, the rows were 4 feet apart and the plants 2 feet. Each plot was therefore approximately 1/134 acre in area.—AGRICULTURAL NEWS.

TOBACCO.

TOBACCO MANURING EXPERIMENTS IN HUNGARY.

K. COLOMAN.

Professor L. Hiltner, Director of the Agricultural Botany Institute of Munich, has drawn the attention of agriculturists to a new manner of using potash salts. He demonstrated in 1911 that potash salts (sulphate and chloride) in suitably diluted solutions, if sprayed on to growing plants, penetrated into them and were absorbed. The effects of repeated spraying were so far favourable that the plants submitted to the treatment, developed more vigorously and gave a higher yield than those not treated. Hiltner's experiments were mostly made on white mustard, soya beans and potatoes.

In Hungary the Royal Tobacco Experiment Station at Debreczen conducted a series of experiments with the object of ascertaining whether this method could be applied to the cultivation of tobacco. The experiments made in 1911 gave negative results on account of the unfavourable weather; they were repeated in 1912, using the large-leaved Szegedi Rózsa variety and the small-leaved selected garden Réthát tobacco, on plots 662 sq. yards in extent. Three weeks after the striking of the plants that had been transplanted (June 11) spraying was commenced, a 2 per cent. solution of sulphate of potash being applied by a common knapsack sprayer. The operation was repeated every seven days up to July 24.

At the same time comparative experiments were made between morning spraying after the dew had evaporated and evening spraying before night fall. In 1912 the weather was favourable to tobacco, as the rains did not begin in Hungary before the middle of August when the plants were already ripening and consequently did not cause any trouble, except during the harvesting and drying. Whilst spraying, care was taken to wet the whole surface of the leaves. With the growth of the plants the treatment involved more labour and proportionately a greater quantity of solution.

With the variety Szegedi Rózsa, planted at distances of 20 × 28 inches (11,200 to the acre), the work was quicker and less expensive than with the Réthát variety planted closer (12 × 20 inches or 27,624 to the acre), as may be seen in Table I.

TABLE I.

Time and quantity of liquid employed in spraying plots of 662 square yards.

Date of Spraying.	Szegedi Rózsa.			Réthát.		
	Labour.		Liquid used	Labour.		Liquid used
	hours.	mins.	gallons.	hours.	mins.	gallons.
June 11 ...	2	—	21·12	5	20	40·48
,, 18 ...	2	50	35·20	8	—	59·84
,, 25 ...	3	20	42·24	8	40	173·04
July 2 ...	4	40	56·32	12	40	114·40
,, 9 ...	5	20	75·68	16	—	32·00
,, 16 ...	10	—	119·68	16	—	142·56
,, 23 ...	12	—	132·00	17	—	158·40
Total of sprayings.	40	10	482·24	83	40	720·72

The expense per acre based on the above data works out as follows:—

	Szegedi Rozsa			Réthát		
	£.	s.	d.	£.	s.	d
Labour ...	2.	12.	7.	5.	12.	4.
Sulphate of potash ...	3.	17.	4.	5.	14.	10.
Drawing water, preparation of solution, carriage, etc. ...	1.	19.	2.	2.	16.	2.
Total. ..	8.	9.	1.	14.	3.	4.

This shows the expense per acre to be considerable for both varieties and distances of planting.

The effect of spraying appears in the more vigorous development of the plant, the greater length of the stems, the more numerous leaves and their fresher colour. This difference was more specially noticed on the plants treated in the morning, while in those sprayed in the evening it was less conspicuous. This fact confirmed the opinion of the writer that the absorption of potash by the leaves was more active in the morning, when the process of absorption begins, than in the evening, which opinion is corroborated by the data on the yields, given in Table II.

TABLE II.

	Plots of 662 sq. yards.	Per acre.	Increase of yield per acre.	Average number of leaves per stem.	Combustibility of the leaves.
	lb.	lb.	lb.		seconds.
Szegedi Rózsa Variety					
Without spraying	226'2	1593'70	—	12.2	20
Morning spraying	339'2	2390'07	796'37	17.5	48
Evening spraying	277'6	1856'47	362'77	14.7	42
Réthât Variety					
Without spraying	287'5	2026'22	—	15.5	13
Morning spraying	426'8	3007'56	981'34	18.1	22
Evening spraying	367'4	2588'98	562'76	16.6	21

It appears from the above that spraying 2 per cent. sulphate of potash solution improved the combustibility of the leaves and increased the yield especially when the spraying was done in the morning.

Table III shows the financial results of the treatments.

TABLE III.

Variety of tobacco.	Cost of spraying per acre.			Value of greater yield.				Deficit per acre.		
	£.	s.	d.		£.	s.	d.	£.	s.	d.
Szegedi Rózsa	8.	9.	1	morning	6.	15.	5	1.	13.	8
				evening	3.	1.	7	5.	7.	6
Réthât	14.	3.	4	morning	11.	2.	4	3.	1.	0
				evening	6.	7.	5	7.	16.	0

The final result of the experiments is a loss in spite of the considerable increase obtained in consequence of the morning spraying and the very favourable weather of 1912.

The writer concludes that the favourable effects of spraying with potash solution under favourable climatic conditions is undeniable, but that the necessary expense is so great that this method will be of no practical importance for tobacco growers.—Monthly Bulletin.

ON "KROEPOEK" OF TOBACCO IN KAMERUN.

KARL LUDWIGS.

In the spring of 1913, a tobacco disease which had already appeared in the previous spring, and was known to tobacco cultivators under the name of "Krauselkrankheit" (leaf curl), was very prevalent in Njombe. From observations made on the spot, the writer ascertained that the disease in

question was not the true "Krauselkrankheit," but "Kroepoek," which at first sight appears very similar to the former affection; according to PETERS it occurs in Java, and more rarely in Sumatra, while it is probably present in Ceylon. The cause of this disease, together with the means of its control, have so far not been discovered.

Already on the young plants the central leaves are seen to develop abnormally, since instead of assuming a vertical position as in healthy plants, they curve partially, rotating horizontally. The upper surface of the leaf has a wrinkled appearance, while the nerves on the lower surface are especially marked and show on their margins excrescence of dark green tissue. The leaves no longer develop normally in length, but give the impression of being contracted into themselves; further they are not straight, but bent, and subsequently the interposed foliar tissue forms protuberances which are directed upwards. In the older leaves, the excrescences have the appearance of leaf-like appendices, having an anatomical structure differing from that found in the normal organ. The size and shape of these out-growths vary, but they are always connected with the principal nerves, or with the more marked secondary ones. The development in length of the whole plant is arrested, infected individuals only attaining to about one-third of their normal height, while their leaves are valueless to the grower.

Microscopic investigations have not revealed the presence of any bacteria, fungi or insects. Various experiments were also made with potassic manures; these, however, gave no results. The soil upon which the tobacco plantations have been made consists of decomposed basalt and is very fertile. The alternation of good with bad crops (from the autumn of 1911 in which the first sowings were made, until the spring of 1913), according to whether the tobacco was planted after the rains, or at the close of the dry season, an alternation which was proved to occur not only at Njombe, where there are the oldest and largest tobacco plantations, but also at Mbanga and Ebunje (Ebinse), strengthened the writer's belief that the degree of humidity of the soil exercises an influence upon the appearance of "Kroepoek," in so far that it is a physiological disease depending on disturbance in the nutrition of the plant. These disturbances, in the opinion of the writer, are connected with the peculiar structure of the soil. The subsoil of the plantations attacked by the disease consists of masses of rock of varying size covered by a stratum of fine volcanic ashes, which at Penja attains a depth of about 20 m. (66 ft.) These ashes, although in themselves very fertile, possess the disadvantage of permeable to water to an extraordinary degree. The sources of all the streams in the district are situated at great depths, and occur at the spots where the masses of rock crop out. It is impossible to dig a well in the plantations on account of the rocky subsoil.

This peculiar structure of the ground prevents deeply seated water from reaching the surface by capillarity; to this must be added the method by which the soil is prepared previous to the planting of the tobacco. All the district is covered by a thick virgin forest which assures to the soil a certain amount of moisture. In order to make a tobacco plantation, it is necessary to fell the virgin forest and completely clear the ground by working it repeatedly. It is easy to understand that the soil loses the greater part of its moisture during these operations, especially in the dry season, and dry soil, as is well known, only acquires moisture with great difficulty. Such are the conditions under which the tobacco plantations occur. After the first felling of the forest, which usually took place towards the close of the dry season, the soil still held sufficient moisture: the atmospheric precipitations of the rainy season followed, and a good crop resulted. Afterwards, the soil was exposed to the sun, the water evaporated without being replaced and the plants consequently became diseased.

According to the writer, the appearance of the disease may be explained as follows. The tobacco plants are first grown in seed plots, whence they are later transplanted to the field. In order to facilitate their taking root they are generally watered, so that they may continue growing and attain a certain height. After this the watering is suspended and the plants are left to themselves. In this condition they form organic substances in their leaves, through assimilation, but they no longer receive mineral substances from the ground, as the necessary water is lacking. Consequently, the water-conducting vessels do not develop normally; the leaves become shrivelled, and the excess organic substances are used in the formation of the excresences and the appendices which are observed on the leaves.

It is noteworthy that, at least according to the researches hitherto made, the plant which has once become diseased never regains its normal development, even if subsequently supplied with water.

The observations made exclude the possibility of affected plantations yielding any crop the same season.

In 1913, the writer advised for the control of the disease, the covering of the soil, after clearing it, with about 18 inches of cut grass; this decomposes forming humus, and thus preserves the moisture for a long time. The results of these experiments are awaited with interest. In any case it would be foolish to abandon tobacco growing, even if a bad harvest is obtained after a moderately wet rainy season, such as was experienced in 1913.

In the Esosung plantations, on the other hand, the soil is also volcanic, but as it contains clay it retains water better. Further, the humidity of the air is such that the soil cannot possibly dry up. In this district, the disease has not made its appearance, and it is possible to plant two tobacco crops in the year.

The writer states, in conclusion, that "Korpoek" does not only attack tobacco, for he has met with it to a considerable extent also upon plants of "makabo" (*Colocasia antiquorum*) growing upon dry soil near the village of Lum. Doubtless the disease could also be recorded as attacking other plants.—MONTHLY BULLETIN.

TOBACCO STALK AS A FERTILISER.

H. D. HASKINS.

As the tobacco plant is a heavy feeder and is cut before the plant has a chance of developing its seed, it is obvious that a large quantity of fertilizing elements must remain in the stalks. Analysis of the latter yielded the following results:—

PER CENT. OF DRY MATTER.

	Stalks from which the leaves were stripped.	
	I. after curing.*	II. in a green condition.†
Nitrogen ...	3·25	1·10
Potash ...	4·95	1·00
Phosphoric acid ...	0·78	0·26

* Havana Seed Leaf variety.

† Another variety.

From statistics collected for Havana Seed Leaf: 8,666 plants are usually grown per acre, and the average weight of 10 stalks (stripped) is 6·58 lb., that is 5,702 lb. per acre. Assuming that the stalks contain 52·94 per cent. of water, the residue of dry matter produced would be 2,684 lb. per acre, containing the following amount of fertilizing material:

		Lb. per acre.
Nitrogen	...	87·23
Potash	...	132·85
Phosphoric acid	...	20·94

Applying the commercial values usually assigned to such material in cotton seed meal or other organic manures, tobacco stalks would be worth about $24 per acre, or about $8·40 per ton of partially dried stalks (i.e. containing 50 to 53 per cent. of water).

Usually tobacco stalks are thrown out on the land in autumn, left exposed to the rain and snow during the winter, then gathered into heaps and burnt in the spring, the ashes being scattered over the land. Analyses of unexposed and leached stalks showed that only a little over 50 per cent. of the nitrogen was washed out during the winter, probably consisting of nitrates and the more soluble amide compounds; therefore the spring burning dissipates about 40 lb. of nitrogen per acre, valued at $7, besides destroying a considerable amount of valuable organic matter. It is recommended that the practice be discontinued, and that the stalks be chopped up and buried.—MONTHLY BULLETIN.

HOW TO MAKE BANANA VINEGAR.

Peel the ripe bananas and place them in a jar or large vessel. Pour off the juice each day as it accumulates; until there is only the coarse spongy debris left. Strain the juice through a thick bit of brown calico (the calico must be washed first), and let it stand until turned to vinegar. The vessel that holds the juice should not be corked, but have a piece of thin muslin tied over its mouth, to let the air in and to keep insects out, etc. The time for the juice to become good vinegar depends on the condition of the bananas used. Indifferent fruit makes poor vinegar. A common way to make banana or mango vinegar is to fill a corn bag with the ripe fruit and hang it over a wooden tub to collect the juice but the flavour of the vinegar is not so good as if a jar or enamelled vessel were used.—JAMAICA AGRIC. SOCIETY JOURNAL.

PADDY.

CULTIVATION IN CEYLON DURING THE NINETEENTH CENTURY.

BY E. ELLIOTT.

(*Continued from page 290.*)

CONCLUSION.

The task I undertook is now completed. I regret the compilation has run to a much greater length than originally contemplated, but this is largely due to a good deal of detail, as regards the districts, gone into in the hope it may prove useful to the officers administering them.

I sincerely trust that the figures I have been able to collaborate in the manner explained at p. 15 and for which I am consequently able to claim a high degree of accuracy, may place beyond dispute that a very substantial addition has in the past been made to the production of paddy. This will, it is to be hoped, prevent the repetition of such an egregious error as was made in the Official Annual Report on Ceylon (presented to both Houses of Parliament) that "there was less land cultivated with paddy in 1904 than there was in 1874." Whereas as a matter of fact there was an increase of 45 per cent. while the production had more than doubled.

I have not attempted to discuss whether "paddy cultivation pays," as the conditions under which it is carried on vary so largely even in the same locality that it is useless endeavouring to reduce to its *money equivalent the outlay in labour and kind.* As SIR A. ASHMORE wrote some years ago: "No one can certainly tell, for though it is possible to measure the receipts, no one can measure the amount of the work, for the fact is that except two or three days of arduous labour at the beginning and the end, the rest consists of a hand's turn done at odd times and is by no means incompatible with the contemporaneous pursuit of other industries." For instance, in the Batticaloa district cultivators of the Munmari (Maha) lands in the interval, between completion of sowing and fencing and beginning of harvesting, engage in the preparation of other lands for the Karaveloma sowing. Again, in the Talpe Pattu of the Galle district, between sowing and harvesting, a large proportion of the cultivators used to work as coolies coaling the steamers at Galle, and probably still do so there or at Colombo, leaving the care of the fields to their female relatives, who frequently even reap the crops, reserving only the treading out of the corn for the men to do, when convenient.

It is the non-recognition of such other "compatible contemporaneous pursuits" and the inclusion of the "whole time" between sowing and harvesting, which has bolstered up the allegations that "paddy does not pay."

Subsequent practical experience and personal observation of the native methods of working have confirmed the opinion I made public many years ago, that a day's labour produces a bushel of paddy, when climatic conditions are fairly favourable or supplemented by irrigation works.

But whether it pays or not, when tested by European standards, is very secondary, and it goes without saying that the first desideratum is to increase the island production of cheap food for home consumption.

The price of rice in the markets of the world has trebled within the last fifty years, and this of course affects those who consume the imported article, whereas the local grain changes hands in the shape of paddy which, being converted into rice by the females of the consumers' household, is consequently much cheaper.

In this connection I think it right to challenge the aspersion in the last census report on the character of the Jaffna agriculturists, as "not disposed to act as pioneers in a country which requires to be opened, and which needs continuous effort for a year or two before they can obtain any profit."

I would suggest in the first place that their poverty is the real cause of their "indisposition" rather than unwillingness to work, for I am personally aware that the development of Batticaloa was largely dependent on the labour of the "field servants" who come from the Northern Province, and were "financed" by the Batticaloa landowners and have eventually themselves become landed proprietors. The fact is that in the East it has been long realised that "Peasant proprietorship is preferable to that of a hired agricultural labourer."

In consequence when opening land in the Hambantota district I found the labour available for hire was almost entirely the floating riff-raff and most unsatisfactory indeed. I could only get a gang of about 30 good coolies for a daily wage. But I had no difficulty in obtaining the services of some 200 real agriculturalists, as cultivators, when I adopted the native method of working on the *metayer* or share system.

It is in the interests of this desirable class and to multiply the number of peasant proprietors that I have framed the scheme given some pages back, for once such a man obtains the possession of a piece of land, the occupier has as a rule no great difficulty in obtaining sufficient credit to "carry on" and, according to native opinion, in four years get his head above water.

No great extension of cultivation can be expected in the Western and Central Provinces, but production can be still further increased in the North-Western and North-Central Provinces, especially by continuing the restoration of the village tanks. But in the Northern and Eastern Provinces and the Hambantota district, there is an enormous area awaiting development by the construction of further irrigation works, accompanied by a considerate, indeed generous, policy regarding the land as already indicated.

Even then, progress in these districts will however be comparatively slow, owing to the small resident population, but in view of the facilities about to be provided for crossing from Ramesweram to Mannar, the possibility of obtaining additional settlers from Southern India for the Giants' Tank Lands should be taken into consideration. It will be necessary to advance funds for transport, maintenance, etc., during the first, and possibly the second year, on deferred terms of repayment and subsequent conditions should be liberal and run on Indian lines of perpetual tenancy as already indicated.

I would further suggest that the time has come for the extension of the South coast Railway from Matara via Deundara, Dickwella and Beliatta to Hambantotta and on to Tissa, in the general interests of the district and especially to provide cheap transport for its salt and the surplus production of paddy already existing, but the sale of which is heavily handicapped by the cost of putting it in the nearest market (Beliatta).

The problem how to get the "people on the land" is now engaging much attention all over the world. Parodying a well-known Scotch grace the situation is as follows :

For some have people, but scarce is land,
And some have land, but none that want it,
But we have land and men at hand,
For which the Lord be thank it.

As the unoccupied land in Ceylon is all Government property, the task is easy, and only requires a truly liberal policy in lieu of the practically prohibitory terms which have of recent years been required especially in the Northern Province.

"There is (as wrote the Editor of the CEYLON OBSERVER) some contrast between the Dutch Policy in Java and that offered in Ceylon. Five years ago BARON TRENT (the head of the splendid Buytenzorg establishment) assured the writer that his attention was first to take care that special allotments of Crown land were set aside for rice to provide for the food of the population. And secondly he gave thought to the great industries of Tobacco, Sugar and Robusta Coffee. (Issue of 20th October, 1913.)

I would commend this view to the newly-created Agricultural authority in Ceylon and add that the extension of cultivation by the poor man on existing native methods should come first, and the endeavour to induce the adoption of what are considered improvements should follow, *festina lente*.

It now only remains for me to express the hope that the various recommendations and suggestions made in these pages, the result of long experience and detailed study of the subject, may receive the favourable consideration of the authorities now ruling in the Island.

Working on some such lines, I firmly believe there will be restored to these backward districts a degree of prosperity such as they formerly enjoyed under Prakrama Bahu the Great (1153—1192) who not only "united the whole of Ceylon in a single sovereignty but as the Lord of the Soil so advanced the affairs of the Kingdom that all the inhabitants prospered and the whole country abounded with food."

In conclusion I desire to express my acknowledgments to the Editor of the TROPICAL AGRICULTURIST, for permitting the publication of this history in its issues ; and for further furnishing me with a number of separate reprints, so enabling me to send completed copies to the Government of Ceylon with the suggestion that they should be distributed especially amongst the several district Kachcheries.

For arranging the publication and for seeing it through the Press, my best thanks are due to my old and valued friend MR. C. DRIEBERG, whose exertions in regard to native agriculture, under considerable difficulties at times, have long interested me, and which I am glad to observe have at length met with suitable acknowledgment in the recent arrangements for an Agricultural Department.

RICE GROWERS' CONGRESS.

The next Congress of Rice Growers will be held in Spain this year. The locality in which the Congress will meet, Valence, is the principal rice-producing region of that country. It will comprehend six sections which will discuss the following subjects :—

(1) Study of the varieties of rice : their importation ; means of preserving characters by selection.

(2) Process of assimilation of fertilisers by rice : modern methods of manuring rice fields.

(3) Cultivation, harvesting, and threshing : the most suitable machinery for these operations, especially for use on small holdings.

(4) Influence of the improvement in methods of rice cultivation in Valence as a cause of the change in the number of draught animals in the province.

(5) The most recent studies on the principal diseases of rice.

(6) The rice trade : need of international regulations to guarantee the authenticity of description and origin.

(7) Co-operation in production and consumption as applied to rice growing.

The holding of the Congress outside Italy is a departure from the rule which has hitherto prevailed and one which it is expected will result in the acquisition of new information and ideas.

THE AGRICULTURAL RESEARCH INSTITUTE, PUSA.

The report on the working of this Institute for the year 1912-13 is to hand and includes besides the report of the Officiating Director (Mr. Mackenna) those of the Imperial Agriculturist, Chemist, Economic Botanist Mycologist, Entomologist, Bacteriologist and Cotton Specialist.

Some idea of what the Government of India is doing for Agriculture will be found when it is stated that on this Institution alone the expenditure for the year under review was four lakhs.

Of particular interest is the report of Mr. C. M. Hutchinson (Agricultural Bacteriologist) on his study of soil bacteriology in India which in time should yield results of great practical value to the Agriculturist.

The report of Mr. Gammie (Cotton Specialist) indicates that considerable progress is being made in the improvement of this crop in the various provinces.

C. D.

FRUIT.

THE BANANA INDUSTRY.

Few people are aware of the origin of the botanical names of the banana—*Musa paradisica* and *Musa sapientum*, signifying the fruit that grew in the Garden of Eden—"the fruit of knowledge."

Though it has been from the earliest times a favourite food with the inhabitants of the tropics it is only comparatively recently that it has become a popular dessert fruit in temperate climes.

The Tea and Coffee Trade Journal for March last gives some interesting statistics with reference to the banana-growing industry and the trade in the fruit.

The annual import of fruit into United States is between 40 and 45,000,000 bunches valued at about 14,500,000 dollars. The imports into all Europe are about the same as that into the United States, but owing to the higher cost these countries only import about one-fourth the number of bunches.

Great Britain ranks second in the value of imports. Fifteen years ago bananas were little known but now they are cheap enough to be within the reach of the working classes. While in 1900 there were some 1,287,000 bunches imported, valued at 2,740,000 dollars: in 1912 the number rose to about 7,000,000 and the value to about 9,600,000 dollars.

Jamaica is the largest exporter of the fruit. In 1911 there were 16,947,385 bunches exported.

Costa Rica ranks second with an export of 10,647,000 in 1912.

Honduras ranks third and is steadily increasing in the value of its exports, while Panama has suddenly developed a large trade in the fruit owing to increased facilities for transport. Colombia too bids fair to become an important exporter of bananas.

The British isles and Europe have drawn their supplies chiefly from the Canarries which in 1912 exported 1½ million to Great Britain, 700,000 to Germany, 400,000 to France, 45,000 to Italy and 30,000 bunches to Spain.

In addition to the raw material there is a gradually increasing demand for banana products such as banana figs, chips and meal, for the manufacture of which a number of factories for drying and evaporating the fruit have been now established in the West Indies.

In Ceylon the largest banana growing area is disposed about Polgahawela and Rambukkana, while there is also a large output of fruit as a catch-crop wherever land is being opened out in coconuts, the cost of the latter being greatly reduced if not entirely covered by the revenue from the former.

In this connection it would not be inappropriate to say a word about the value of the banana as a food. There has recently been a futile attempt to condemn the fruit as a contributory cause of appendicitis, but the vigorous

replies to this unfounded charge, made by such eminent authorities as SIR DANIEL MORRIS and SIR JAMES CRICHTON-BROWNE have gone far to explode the fallacy of a bold theorist.

A recent issue of the WEST INDIA COMMITTEE CIRCULAR contains a valuable contribution on the subject of the food value of the banana from the pen of DR. ALFORD NICHOLLS who is perhaps better entitled to express an opinion on the question than any one else, inasmuch as he speaks with the experience both of a medical man and an agriculturalist. He is satisfied that the banana contains all the elements necessary for the sustenance of the body, and that it is eminently suitable for persons of weak digestion. He has successfully treated persons suffering from intestinal disorders (such as dysentery, enteritis and sprue) by prescribing a diet of bananas for lengthened periods. How can any medical man, he asks, gravely assert that the banana causes appendicitis ?

C. D.

BANANA CULTIVATION.

(*Contd. from p. 297*)

SOILS.

The richer the land in humus the better for bananas, so long as the soil is not sour or boggy. They will not grow on all soils successfully or naturally; to make unsuitable soils grow bananas means additional expense. At the same time bananas are now being grown on soils and in climates in Jamaica where a few years ago it would have been deemed impossible to grow them commercially, and this is done simply through cultivation and drainage on the heavy lands, and on the lighter and drier soils through a process of deep mulching with guinea grass cut from the pastures; or bush, and leaves cut from the woodlands, and spread over the surface of the soil. If land is once saturated by rain and then mulched, the soil which becomes hot and dry with strong sunshine is kept cool, retains moisture long, and remains soft; and it is further enriched also by every shower carrying down food material from the mulch. Few weeds can grow through a thick mulch, and although the process of getting it and applying it is expensive, yet in the end through little weeding and cultivation of the soil being necessary, the total expense is often actually less than in the wetter districts where two to four weedings per annum, two to three forkings or ploughings, and deep drainage are necessary. As the mulch requires renewal from time to time, there is thus also a constant addition of manure, making the land richer, although the primary purpose of the mulching is simply to protect the surface of the soil and prevent the evaporation of moisture.

At first planters in Jamaica preferred only the rich alluvial sandy loams along the river valleys; the soils there are always rich, flat and easy to work. There is always danger however, from heavy floods causing damage. Where these lands are situated that a flood does not run quickly off the land and so scour it, but eddies and goes off gently, there is usually a rich deposit of mud and debris, left so that the increased fertility often more than makes up for any damage done to the plants.

It was found, however, that the so-called black soils common all through the central districts of Jamaica (which generally run from an elevation of 1,000 to 2,800 feet), derived from the old yellow lime stone formation, which consists of a black, fertile, surface soil, and with a stiff yellow clay, orange in colour, grew excellent bananas, with tall thick stems and fine bunches, having large fingers closely set together on the hands. This soil if turned up and broken roughly in large clods a month or more before planting, readily crumbles by exposure to the sun, air and rain. In continuous wet weather such a soil gets soggy, and the bananas grow slowly then, so that such lands require good drainage and when this is done there is no better soil for bananas. It is a rich and lasting soil too. There is another kind of yellow clay sub-soil however, not good for growing bananas. This is of a very soapy or rather greasy consistency, but is of a light yellow colour. This is, however, an excellent soil for sugar cane.

There are also black clay soils in the lowlands, but they are not so common as the yellow clays, nor are they so good. If this soil is a dark black, however, it grows bananas given good drainage. If of a grey colour and greasy consistency, it is not usually a good soil to choose to grow bananas on.

Then there is a conglomerate or broken rock soil, consisting of loose brown loam mixed with gravel, sometimes sharp, sometimes round. These are usually good banana soils (if they have not been worked out from long cropping with other crops like yams and sweet potatoes), easy to work but easily washed and gullied by rain, so they require trenches with hillsides, not to aerate the soil and relieve it of surplus water, but to prevent wash. The trenches act like pits and collect the sediment which otherwise would be washed to the bottom of the valleys. And the drains also help the soil to retain moisture, as much water instead of running over the land is retained, to percolate slowly through the soil.

There are red soils over large areas consisting of a deep free loam, very easy to work, very porous, easily dried out, yet very fiery, but they apparently contain much plant food as they grow grain, root crops and coffee better than most other soils. But no matter how they are worked in the ordinary way, they would not grow bananas, unless around houses where they happened to receive plenty of manure. But manure could not be found for large acreages, so bananas were not grown on red soils unless in small pieces where they could be dosed heavily with animal manure dug in. It was found, however, that by a simple process of surface mulching, that is laying a covering of grass or bush over the soil, nothing more was required to enable bananas to be grown successfully. The mulch evidently neutralizes the fiery heat of the red soil and prevents it drying out quickly. There are other soils containing what is called "shot," or small iron pellets which in dry weather appear to get heated and burn the tender roots in the soil. They are usually stiffish soils where shot appears and they are avoided for banana growing after experience of them. But with drainage through every second row of bananas on these soils, and heavy mulching either by green leguminous crops or grass applied, bananas can be successfully grown. It has to be calculated whether this expense is justified in results.—Jamaica Agric. Society Journal.

THE DATE PALM.

Mr. Popenoe has pursued his investigations not only at home but in the chief date-growing countries of the world. His journeys have extended from the North African littoral and deserts through Turkey and Persia into India. He observed in the last named country that "there has been during the last half-century a small but continuous effort to establish the Date Palm on a large scale;" and he holds out some hope that in some localities these efforts may meet ultimately with success. Mr. Popenoe's enthusiasm for *Phœnix dactylifera* is almost equal to that of Mohammed, who proclaimed that "There is among the trees one tree which is blessed as is the Muslim among men; it is the Palm. Honour your uncle, the Palm: I call him your uncle because he was created from the earth left over after the creation of Adam.....The Palm resembles man by its erect position and its height, by its separation into two sexes and by its necessity for the pollination of the female. If its head is cut off it dies.....Is it not the same with man? If its leaves are cut off it cannot grow others in the same place; no more can man if he lose his members. It is covered with a fibre analogous to the hair of man." To those only familiar with the Date Palm in pictures or pots the most striking point of Mr. Popenoe's account of its "cultural requirements" is the need of the Date Palm for large and continuous supplies of water. It grows and fruits best when well and even constantly irrigated. Thus in Persia the immense plantations around Busreh are irrigated naturally and copiously every twelve hours throughout the year. Indeed, the author maintains that irrigation is the principal item in the cultivation of the Date Palm. Apart from this need for water the tree is not exacting. It grows and is fruitful in light and heavy soils, responds well to manuring with dung and humus, and in the adult stage withstands winter frosts; though it must be protected from wind. It is found advisable, however, to protect the ripening fruit.

Propagation may be effected by seed or by off-shoots, but as the author insists, the latter mode of propagation is by far the better, and this for two reasons. First, the offset from a female Palm is of course female, whereas, of seedlings, about half are male and half are female, and hence large numbers of useless male plants must be grown until they declare their sex at flowering time, when those not required as pollen-bearers must be discarded. Second, as is the case with all long cultivated plants, Date Palms are extremely variable, and hence the offspring of a choice kind are anything but true to the characters of the parents. The work of breeding pedigree races, which has been undertaken in America, will without doubt meet ultimately with success; but in the meantime offsets from fine forms should be used, because, as is the case generally with sexually produced plants, they are true to character.

That the Date Palm fails to set seed unless the female is pollinated was known centuries before the present era, and bas-reliefs on Assyrian monuments illustrate the operation of pollination. Mohammed never showed his astute genius better than in retrieving the great error into which he fell when he forbade the artificial pollination of the Date Palm on the ground that it is an unnatural practice. The obedient followers of the prophet abstained, and the harvest was barren. As Mr. Popenoe puts it, "an indignation meeting

was held," and as a result the Prophet announced, "You are weak in spiritual knowledge, but are worldly-wise; therefore in future I will confine myself to the government of your spiritual welfare, and let you manage the affairs of this world to suit yourselves,"—a pronouncement bound to be acceptable to a race of people with commercial instincts.

To secure crops, artificial pollination must be, and is, practised both in the Orient and in Occidental countries—wind pollination is too uncertain and insufficient. The male inflorescence with its spathe is detached as soon as it is mature, the spathe is slit open and the sprigs of male flowers are removed and placed in a basket for twenty-four hours. The cultivator climbs a tree on which the female flowers have burst their spathe and inserts several clusters of males among the females, and ties them in their place. If kept dry the pollen lasts a long time, and it is interesting to observe that it is customary in some districts to keep pollen from year to year. Trials made at the Mecca Experiment Station have shown that pollen may be kept for seven years and retain its power of fertilisation. Equally interesting is the statement that fertilisation may be effected by the pollen of other species of Phoenix, e.g., P. *canariensis*, and with other genera of Palms such as Washington filifera and the Mediterranean dwarf palm, *Chamerops humilis*. Growers are advised to establish three or four males for each hundred females. An old statement by Schweinfurth (in 1901) that the qualities of the fruit are influenced by the pollen used for fertilisation is said to be borne out by recent experiments made by Bruce Drummond in California. This statement is by no means in disaccord with modern views on fertilisation, and might well be tested in fruits other than Date. We need not follow the author in his estimates of the profit of Date-growing nor into the methods devised for ripening the fruit artificially, although these are matters which to our readers in sub-tropical countries are of considerable interest; but we may conclude our review by recommending horticulturists generally to read this entertaining and beautifully illustrated work, for we are assured that whether they grow Dates or not it will bring them both pleasure and profit.—Gardeners' Chronicle.

PROPAGATING DATE PLANTS.

PROPAGATION BY SEEDS.

If 100 seeds are sown, about 50 of the seedling plants will probably be male trees, and will, of course, bear no fruits. Of the 50 female, perhaps 10 trees or fewer will yield passable fruits; 5 or 6 of these will probably yield fruits of a quality equal to that of the mother tree, and one, or not even one, may yield fruits superior to hers. The characters of the male and female palms used to produce the seeds will, of course, materially affect the number of useful seedlings got.

AGE AT WHICH THE SEX OF SEEDLINGS CAN BE KNOWN.

The sexes cannot be known with certainty till the tree bears flowers; and as this will occur five to ten years after the seeds are sown, land, labour, and water will have to be provided for 100 trees for from five to ten years before the 90 more or less useless trees can be weeded out, and the ten, or fewer, passable ones can be selected.

BEARING OF DATE SEEDLINGS.

The seed-bed should be prepared in March or April* as for any ordinary farm crop. The seeds should be planted in it to a depth of from 1 to 2 inches in rows, 3 to 4 feet between the rows, and then irrigated. The bed should be watered once a week till the seedlings show above ground, and should then be watered as frequently as will keep the ground moist enough to grow any ordinary farm crop. The seedlings are extremely hardy. If they are well treated they will grow faster and come into flower sooner. They repay good treatment well, as only when they come into flower and fruit can the fruitless males and worthless females be weeded out. When three to four years of age, every alternate plant may be taken out of the nursery and planted elsewhere. The remainder may be left until flowers and fruits are shown, and the worthless varieties can be thrown out. If they can be left in the seed-bed without choking each other up, they may all be left there until they show flowers or fruits. Transplanting may be done as in the case of off-shoots (as will be described later). The rearing of date trees from seeds is not advisable for ordinary date cultivators when good off-shoots can be obtained,

THE FRUIT FORMED AS AN IMMEDIATE RESULT OF POLLINATION NOT AFFECTED BY CHARACTERS OF THE MALE.

The reason that so few good female trees are got from ordinary seeds is, that the female trees are generally pollinated by male trees of inferior quality, and they, of course, influence the offspring. As the female trees are almost always propagated by off-shoots in date-growing countries, and the fruit formed as the immediate result of pollination which is not affected by the character of the male used, ordinary dategrowers have no incentive to breed good male trees.

ADVANTAGES OF PLANTING BY OFF-SHOOTS.

In ordinary date cultivation, propagation should be done by off-shoots. No useless trees have to be cultivated if this method is adopted, as all off-shoots from female trees will become female trees, and will yield fruits of the same quality as the mother tree. By planting off-shoots, therefore, it is possible to obtain a plantation of trees all yielding fruits of exactly the same quality. Where the date trees are reared from seeds, no individual tree bears fruits exactly like those borne by any other, and therefore the cultivator cannot supply a large quantity of fruits of exactly the same quality. This is a very important disadvantage for trading purposes.

TIME OF YEAR TO SELECT OFF-SHOOTS.

Off-shoots should be selected when the fruits are ripe and hanging on the mother-trees, as at that time there can be no doubt about the quality of the fruits that the off-shoots will bear. The trees from which off-shoots are required should then be marked with paint or in any other convenient way, and their positions recorded in a note-book, a rough plan of the positions being made if necessary.

DETACHING SUCKERS FROM FEMALE TREES.

The off-shoots are severed from the parent tree by means of an ordinary axe, the cutting being done in a plane parallel to the stem of the latter. The cut should be made as near to the tree as possible without unduly harming it.

*About September or October in Queensland.

The axe should be sharp and the blows light. Every care should be taken not to shatter the off-shoot in removing it from the mother. The wound on the mother should be earthed up at once, and it is well to first coat the wound with coal tar or other material generally used to cover plant wounds.

SIZE OF SUCKERS TO BE TRANSPLANTED.

Off-sets to be transplanted should have all the adult leaves cut back. Practically nothing but the tender young leaves in the central bud and the bare stalks of the old leaves should be left on the plant. The object in doing this is to reduce the amount of water transpired from the transplanted off-shoots through the medium of the leaves owing to being severed from its parent. If the amount of water given off by the leaves is greater than that taken up from the soil the plant must dry up, and will die. After the adult leaves have been trimmed back, the off-shoots should not weigh less than 6 lb. Off-shoots less than this usually die when transplanted, as, if by any chance the amount of moisture in the soil around the off-shoots becomes less than what is required, the plant has not sufficient strength in it to replace those rootlets that may have been dried up. From the weighment of a large number of plants, I find that the average weight of an off-shoot when trimmed and ready for planting is 12 to 15 lb. Off-shoots are usually fit for transplanting when they are three to four years old, but the larger the off-shoot is the better, as there will be less danger in shattering it when removing it from the parent tree, and more chance of its doing well when transplanted.

TO INDUCE OFF-SHOOTS TO FORM ROOTS.

Six months to a year before the off-shoots are removed earth is sometimes piled up round the bases of the mother trees and kept moist. This induces the off-shoots to send out rootlets, and increases their chances of taking root when planted out.

CARE OF OFF-SHOOTS AFTER REMOVAL FROM THE PARENT TREE UNTIL PLANTED.

When suckers are transported long distances, and a considerable time elapses before they can be planted, it is advisable to coat their bases with mud, and cover them with palm fibre, grass, or straw and matting, leaving the crown of the off-shoot exposed. The palm fibre is kept damp by occasional sprinkling with water. The water must be applied lightly, otherwise the mud tends to be washed off the palms. The mud used should have rather more sand than clay in it, and should be about as thick as cream. Dipping is done in a box or in a hole in the ground which should be at least 6 in. wider than the diameter of the largest sucker, and 6 in. deeper than the largest base to be coated. The box or hole is filled with mud, and a sucker is placed in it and withdrawn. It is then immediately bound in wet fibre, &c. If many trees are to be treated, a larger hole is better, as it has to be refilled with mud less frequently. Care is taken not to admit the mud into the crown of the plant. . . . . Suckers have been known to keep healthy for about three months when treated in this manner (Gaskin). The bases of the off-shoots may be simply bound up with a covering of palm fibre to protect them during transport to where they are to be transplanted. More frequently, no packing of any sort is done. They should, however, have their bases placed in water on the same day as they are removed from

the parent tree. If this is done, and the off-shoots are strong, probably little harm will happen to them if they are not planted for a month. It is well to plant them as soon as possible, however.

COST OF OFF-SHOOTS IN ARABIA.

In Basia, in 1910, the cost of 100 date-suckers fit for transplanting ranged from 50 to 75 rupees (£3 6*s.* 8*d.* to £4. 3*s.* 4*d.*).—Queensland Agric. Journal.

GRAFTING THE PAPAW.

The method of grafting the Papaya is so simple that it seems remarkable that it was not discovered earlier. The difficulty evidently lay in the fact that a bearing papaya tree under ordinary circumstances has no bud wood for grafting purposes. After a seedling begins to fruit, it does not normally produce side shoots which can be used for grafting. It has been observed for some time, however, that if the top of a bearing tree is cut or broken off accidentally, a large number of shoots begin to form, one from the upper part of each leaf scar, that is the axil of the leaf. This takes place three or four weeks after the tree is decapitated. It is these small shoots, of which as many as fifty or more may be produced by a single tree, that are used in grafting the papaya. One of the shoots is taken when a few inches long and about the diameter of a lead pencil, is sharpened to a wedge point, the leaf surface reduced, and inserted in a cleft in a young seedling papaya plant which has been decapitated when 6 to 10 inches high, and split with an unusually sharp, thin grafting knife. At this age the trunk of the young seedling has not yet formed the hollow space in the centre. It is not necessary for the stock and the scion to be of equal size; the scion should not, however, be larger than the stock. After inserting the scion, the stock is tied firmly, but not tightly, with a short piece of soft twine. The grafted plant should be shaded for a few days after the grafting has been done, and the twine should be removed on the sixth or seventh day. The best success has been secured in these experiments by grafting potted seedlings in the greenhouse or under the shade of a lath house, presumably because the stock can be kept in good growing condition under these circumstances. Under these conditions fully 75 per cent. of successes can be expected. In the field, also, this method has been successfully followed.—Queensland Agricultural Journal.

TOMATO SOILS.

Although the tomato can be and is largely grown on many different types of soil from heavy clay to light sand, there is no doubt that the soil which provide the best conditions for the culture of this fruit is a deep, fertile, sandy loam with a well-drained clay sub-soil. An Indiana (U. S. A.) State Bulletin says that the highest yields are secured on sandy loam soils, well drained, and comparatively rich in plant food. On the heavier soils, the yields have not been so large as on the lighter types although the tomatoes are usually more firm and meaty, which makes them better for canning. On lighter soils, as a rule, the fruits are more juicy and the meat is less solid. Then, again, the fruits of many varieties, especially the early ones, are smoother and more symmetrical when grown on sandy soils.—Queensland Agricultural Journal

NEW CITRUS TREES.

One of the most remarkable of the wild species of the genus Citrus is definitely described for the first time in the Journal of Agricultural Research, vol. i., No. 1.

The reader may remember that the question of wild citrus species was dealt with in the last issue of the Agricultural News, and the present account forms, therefore, an interesting and important continuation of the subject.

The species under consideration has been named *Citrus Ichangensis*, Swingle. As far as is known, this plant is native farther north than any other evergreen species of citrus, only the deciduous *C. trifoliate* having a more northerly range. Besides having the most northerly range of any known evergreen species of citrus, it occurs at the highest altitudes reported for any other wild species of the genus.

C. Ichangensis is cultivated in China in the vicinity of Ichang ; and it bears a very large lemon-like fruit that is of sufficiently good quality to cause it to be shipped to markets several hundred miles distant.

In the space of this article it would not be possible to reproduce in full Swingle's description of the species, but it may be noted that the species differs from its congeners in having very large thick seeds and slender leaves four to six times longer than broad, with very large winged peticles often as large or larger than the blade. It differs from *Citrus histrix, D.C.*, in having oblong rather than triangular winged petioles and much larger flowers with conate stamens. The bulky seeds of *Citrus Ichangensis* with their large brown caps and thickly formed cotyledons are not at all unlike those of the African species of hard-shelled citrus fruits belonging to the *genera Balsamo citrus* and *Æglopsis*.

A wild species of citrus—collected by Hooker and Thompson, in 1850, amongst the Khasi Hills, in Assam—has been described by Swingle, as a sub-species, namely, *Citrus Ichangensis latipes*, Swingle. It differs from *C. Ichangensis* in having the leaves more variable in size and shape with the tops acute, not caudate, the flowers in few-flowered (three to four) panicles instead of solitary, and the fruits oblate instead of prolate spheroidal in shape. The fact that Hooker and Thompson called this plant a wild orange is additional evidence that the lemon-like appearance of the Chinese form is a constant sub-specific character.

POSSIBLE USES OF THE SPECIES.

The large size of the seeds makes it probable that *Citrus Ichangensis* will produce vigorous seedlings, and hence it is likely to be of value as a stock on which to graft other citrus fruits. The numerous large seeds, however, possess the drawback of greatly reducing the proportion of juice because of

the space they take up. Since the plant is a native of China and Assam, and very hardy, its suitability for growth in the Southern States is practically a foregone conclusion, and there is every probability that this species will play a great part in the development of citrus cultivation in America. In conclusion it may be pointed out that the discovery of *C. Ichangensis* in a part of China as accessible as *Ichang* is a further proof of the rich harvest of new species of plants that awaits the botanist and agriculturist in China.

The QUEENSLAND AGRICULTURAL JOURNAL also reprints the following from the AGRICULTURAL NEWS, Barbados. In connection with the above account, attention may be called to an article in the AMERICAN BREEDERS' MAGAZINE (July-September, 1913), dealing with *Cudrinia tricuspidata*, a representative of the natural order *Moracea*, and recently introduced to the United States from China. Its fruit, although small, is sweet and edible, and because of its hardiness, the shrub can probably be grown in the southern half of the United States. In China, the leaves are used for feeding silk worms at times when mulberry leaves are scarce. It is believed that it might be usefully employed for hedge purposes, and there appears to be little doubt that the fruit, if successfully crossed with the Osage orange, will provide a progeny-yielding produce of greater value as food for live stock

DROUGHT-RESISTING CROPS.

Recent dry years have brought to light a new drought-resisting plant called Feterita. Its fine yields of grain in the severe drought of 1911, when both Milo and Kaffir Corn gave comparatively low yields, caused it to become quite popular in parts of Northern Texas. This year quite a number of farmers in other sections tried it.

Feterita greatly resembles Milo in its earliness, size and height of stalk, its relatively dry pith and few leaves. The heads are similarly shaped but more erect, while the seeds are somewhat larger and whiter. The Government Expert says :—"Experiments so far indicate that its earliness, its rather low water requirements, its satisfactory yields, and the ease with which it may be harvested, give it a real place among the Sorghums, either for grain or combined grain and forage purposes."

The samples were cut September 8, from a field that had not received rain, or even sufficient showers to lay the dust, since the seed was planted on May 20, 1913."—BREEDERS' GAZETTE.

SOILS AND MANURES.

EFFECT OF GREEN MANURING ON CLAY SOIL.

To the Editor of the "Tropical Agriculturist."

Sir,

You will please publish the following interesting and instructive fact in your valuable journal "The Tropical Agriculturist."

In the State Farm, Pudukotah, a small alkaline piece of wet land of about 11 cents was grown with a green manure crop of Daincha (Sesbanea acculeata) last year, late in February. Plants grew up to a height of eight feet in about seven months and in the latter half of September they were pulled out by the roots when the land was subjected to flooding immediately after the rains. A considerable quantity of leaves had already been shed on the ground and now the tender twigs of the plants formed an additional application. The thick stout stems were choped off and used as fuel. The clayey nature of the soil that rendered ploughing more difficult before was now made lighter, drainage having thus been a deal improved. On subsequent operations paddy was transplanted in singles as heretofore. Strange as it may appear, there was an even stand of the crop throughout the field. Tillerings were more free and profuse. No objectionable weeds could be seen. In fact the general luxuriance was on the whole a very attractive feature of the plot. As against 75 lb. of paddy obtained the previous year, an abnormally good outturn of 450 lb. of paddy has been secured during the current fasali.

Yours faithfully,
K. P. SANKAR,

Pudukotah,
25th March, 1914.

MANURES AND THE RIPENING OF SUGAR-CANES.

A considerable amount of work has been done in different places on the influence of manures on the composition of sugar-cane, but it does not seem to have been established that even excessive manuring affects injuriously the quality or quantity of the juice. In Hawaii, for instance, extremely large dressings of manure are used without apparently any harmful effect upon the productivity of the crop. In the Leeward Islands it has been shown that manures exert their influence chiefly in increasing the weight of cane per acre. No profound alteration in the weight of sucrose to the ton of cane was demonstrated. From experiments in general, and

from those under consideration in particular, it would appear that any harmful effect resulting from excessive dressings lies principally in a delay in the time of the maturity of the crop.

In order to observe the effect of manures, applied as top dressings to the cane at its most active periods of growth, a series of experiments were laid down at Sabour, India, for the season 1912-13, and the results obtained are summarised in the following paragraphs :

It was found, first of all, that the addition of super-phosphate had little or no effect upon the date of maturity of the crop. On the other hand a dressing of sulphate of ammonia delayed the ripening of the cane for about half a month, but the ultimate sugar content of the juice was not affected. It has sometimes been stated that the addition of sulphate of ammonia will increase the juice extraction to a considerable extent. This assumption was not substantiated by the experiments under review.

In conclusion it would appear that a top dressing of manure seems to weaken the juice of the sugar-cane at the beginning stages of coming to maturity, and delays its actual ripening for about a fortnight, but it is only a delay, and not a prevention of ripening, as in the case examined, the treated plots appear to have given juice of almost the same richness as the blank plots, the only difference being that the stage of maximum maturity was reached a fortnight earlier in the case of the plots which did not receive a top dressing.

Further details concerning these experiments may be obtained by reference to Bulletin No. 37, Agricultural Research Institute, Pusa.—

AGRICULTURAL NEWS.

SOIL INOCULATION.

It is a simple proposition, and yet to a great many farmers it looks so remote and mysterious that they do not clearly understand it, and so they cast it aside as some crank notion or humbug. Yet, it is the absolute keystone that holds the arch. The principle is this: All of those plants that are called legumes, like all of the clovers and lucerne, including peas, beans, and vetches, require the deposit on their roots of certain bacteria. These deposits are in the form of small colonies and are called "nodules."

Dig up a healthy clover or lucerne plant, and shake the dirt gently from the roots, you will see these nodules clustering on the finer roots about as big as a small pin head. The microscope discloses that these nodules are filled with certain bacteria that have the power to absorb the free nitrogen of the air, and change it over into plant nitrogen. What makes lucerne or clover valuable as a feed is its percentage of protein, which is another name for nitrogen. Milk and meat and the bodies of all animals require a great deal of nitrogen.

So we see that the soil must be in that condition to create and make a home for these bacteria, or else the clovers and lucerne will not live and flourish well.

Go into some fields of lucerne, and you will note spots where the plants look unhealthy, yellow, and starved out. Dig down to the roots, and you will find no nodules there. Why? Possibly, and very probably, it is because the soil is too acid for the bacteria to exist. Exist they must, or the clover and lucerne will fail. Each one of the legume plants has its own kind of bacteria. Those on the lucerne are unlike those that inhabit the clover.

There are three prime lessons to be learned by the farmer in the consideration of this subject:—

(1) He must take the word of those scientists who have investigated the matter. Because he cannot understand it is no reason that it is not true. We have heard scores of farmers say that all this talk about bacteria was a humbug. But they spoke the words of ignorance, not wisdom.

(2) When a farmer is introducing lucerne upon his farm, it is fair to suppose that there are no bacteria in his soil that belongs to that plant. It is a simple matter for him to take some bags and go over to a farm where lucerne does well, and get a few hundred pounds of soil from the old lucerne field. This should be done on a cloudy day or just at nightfall, when the sun is not shining brightly, for, true to its purpose, the sunlight will kill the bacteria if they are exposed to its rays.

Keep the dirt in the dark, and apply it to the surface of the newly-sown lucerne field at the rate of about 500 lb. to the acre. Do this just at nightfall also. Now the effect will be to inoculate the soil with these bacteria. They make their way at once to the young lucerne roots, and there is altogether a different growth.

Or in place of soil from a lucerne field, if more convenient, get some of the commercial inoculating material called Nitragin, which is applied to the seed, and with its multitude of bacteria is carried to the soil with the seed. It has been noticed that lucerne, as well as clover, is a great deal more hardy, stands severe cold weather and all sorts of discouragements better, when there are plenty of its favourite bacteria in the soil.

The third lesson is an important one. If the soil is too sour, it must be sweetened. When clover does not grow well and is easily winter killed or summer killed, it is a pretty sure sign that the soil is in a bad condition for it, It is quite apt to need two things—lime and phosphate. The same is true of lucerne. The bottom reason for this is that the bacteria, necessary for the health of the plant, cannot live in that soil because of a lack of lime. The phosphate is also necessary to the growth of the plant.

The more we look into these things the more do we see the need of using the mind in a study of the real meaning of the facts as they exist. Very often it takes ten times as long to know what to do as it does to do it when we know. A large proportion of men weary of study a gread deal quicker than they do of hard work. But we have noticed that the richest rewards come to the men who think and study. Blind, unthinking labour never made anybody prosperous.—Farm Bulletin.

DISTRIBUTION OF MANURE IN DRILLS.

BELA JANCSO.

Considering the great interest recently shown by Hungarian farmers in the question of distributing manures in drills, and the widely spread use of mixed drills for seed and manure built by several agricultural machine manufacturers, the National Society of Hungarian Agriculturists (Orzsagos Magyar Gazdasagi Egyesulet) resolved, at the beginning of 1912, to exhibit such machines various of makes, with the object of examining them from a technical point of view and of determining their value by actual experiments.

The plan of these experiments, conducted on the estate belonging to the Hatvan sugar factory, was drawn up by the Royal Agricultural Experiment Station of Magyarovar, which was besides entrusted with the execution and supervision of the trials and with the examination of the material tested.

EXPERIMENTS WITH SPRING BARLEY.

These experiments were carried out by five distributors of various systems, but owing to the too frequent rain the barley lodged, especially on the plots manured with chemicals. The yields of the various plots were nearly the same and no decisive result could be arrived at. Nevertheless it was seen that a moderate dose of superphosphate and nitrate of soda given in drills has no ill-effect on the germination of the seed, and rather hastens the first development of the young plants.

SUGAR BEETS.

The experiments with beets, carried out on the same plan, were more successful. Each of the five machines had to work upon 6 plots, each 1·42 acres in extent, and manured as follows:—

Plots 1 and 4	No manure
,, 2 ,, 5	186 lb. of super and 46 lb. of nitrate spread broadcast, over the whole surface
,, 3 ,, 6	93 lb of super and 23 lb. of nitrate in drills

The machines worked on the 15th and 16th of April.

Observations showed that manuring in drills acts better on the development of sugar beets than manure broadcasted, and its benefits were visible throughout the whole period of growth. On October 7 samples were taken from all the plots; in the sugar content no great differences were noticeable, but as to the size of the beets there was a difference in weight in favour of manuring in drills. In the experiments the average weights were:—

	Series of plots I	Series of plots II
	grams	grams.
Without manure ...	321	321
Manure broadcasted ...	371	373
Manure in drills ...	398	395

The yields per acre averaged as follows :—

	Series of Plots. I	Series of Plots. II	Average.	Surplus over control plot.
	lb.	lb.	lb.	lb.
Without manure, control ...	17,492	17,450	17,470	--
186 lb. super and 46 lb. nitrate, broadcasted ...	18,703	18,233	18,468	998
93 lb. super and 23 lb. nitrate, drilled ...	19,751	19,406	19,578	2,107

From the above table it will be seen that half the dressing drilled gave a surplus over the control plot more than double that obtained by the whole dose when broadcasted. It must also be mentioned that the sugar beets were affected by the great drought of July and August, without which the yield would have been much heavier.

That the drilled manure produced a better result than twice the dose spread broadcast might be explained by the supposition that the soil of the Hatvan estate, being rich in humus and well cultivated, did not require a greater amount of manure. According to this view the use of a larger quantity of manure broadcasted, the effect of which would be slower but more durable, should have proved more advantageous on poor and badly cultivated soils. But during the course of the experiments this objection was completely removed, quite by chance. The extremities of the experiment plots were formed by a piece of exhausted land belonging to an adjacent estate, which had been only recently rented. As all the plots ended in this land the development of the beets could be observed. Here also the result of manuring in drills were striking throughout the whole time from the germination of the seed to the time of lifting.

	Series of plots I, grams.	Series of plots II. grams.
No manure	117	100
Manure broadcasted	174	186
Manure drilled	226	223

It appears from the above figures that in exhausted soils the drilled manure was more active than twice the amount broadcasted, for while the latter yielded nearly twice as much as the check plot, the former yielded

nearly three times as much, as is shown by the following figures per acre :—

	Series of plots.		Average.	Surplus over control plot.
	I.	II.		
	lb.	lb.	lb.	lb.
Without manure, control ...	3,445	3,411	3,428	—
Broadcasted Manure ...	6,740	6,678	6,709	3,281
Drilled Manure ...	9,375	9,362	9,368	5,940

The Hatvan estate having found that drilling manure is more advantageous than broadcasting it, has definitely adopted the former method for all the crops.—MONTHLY BULLETIN.

SOIL EXHAUSTION.

Each time a crop is taken off the land, it takes with it all the ingredients which have built up the plants. If these materials are not replaced in some way or other, it is clear that, after a time, longer or shorter, according to the natural fertility of the soil, the whole of the plant food which the roots can reach will be carried away, and the land becomes unproductive; but, in reality, there is no such thing as an exhausted soil. The plant food is there, but it is out of the reach of the roots of the plants, and requires to be brought up in some way or another to become available. Constant cropping has certainly removed the fertilising matter from the surface, and such being the case, good crops cannot be produced, and in this sense, too, land is said to be exhausted.

In China, the production of crops has been carried on for thousands of years, as far as records can be traced, and conducted in an extensive manner. The soil, after these thousands of years of cultivation, is as productive as ever. The Chinese have always understood the necessity of restoring to the land the supply of nourishment extracted from it. They may not understand the chemistry of the subject, but long experience has been a good master. Lands in Europe which have been cropped for hundreds of years still continue to yield heavy crops.

Some six or seven years ago the Bureau of Soils of the United States Department of Agriculture put forth an entirely new theory on the subject of the so-called exhausted soils. As a matter of fact, the Bureau declared that a soil does not become exhausted by constant cropping, that the mineral plant food is always there, being reproduced as fast as it is absorbed by the crops. The cause of the failure of the soil to produce good crops is the formation of some chemical poison when one kind of crop is being continually grown. This idea naturally causes one's mind to consider lucerne-sick and clover-sick soils as containing such poisonous elements. To obtain confirmation of the new theory, PROFESSOR WHITNEY made systematic

experiments, of which the following is a summary :—

"In order to test the idea, and find out if we were safe in announcing such a fact as this, so revolutionary as regards our former ideas, the Bureau of Soils has had parties in all parts of the State equipped with the most sensible methods of making these determinations in the field. We have taken out of the soil its own moisture, and have actually found similar quantities of phosphate of potash, of nitrates, and of lime, in the sandy soils of our truck region, in the 'worn out' soils of Virginia, in the fertile limestone soils of Pennsylvania, and in the black prairie soils of the West.

"We then went into the question of how much plant food is necessary; how strong a concentration the solution must have to support a growth of plants, and I may tell you investigators are not able to say how small the amount of phosphoric acid or of potash in the solution must become, if other conditions be maintained perfectly, before the plant will suffer. Plants have an extraordinary power for absorbing material from solutions. Take the case of the seaweed, from which iodine is extracted. Sea water has so little iodine that, although we have an exceedingly delicate method for the detection of iodine, we cannot discover it, even if we concentrate the water to a very small part of the original bulk; but the seaweed can get it and store it up in its tissues from that very diluted solution."

Other experiments were made, and all of them pointed to the same conclusion: The difference of yields between fertile and what was popularly regarded as "exhausted" soil was not due to a difference in the supply of available plant nutrients. The suspicion was born that the unproductiveness of so-called worn-out soils was due, not to the absence of anything necessary to the plant's growth, but to the presence of something deleterious to its growth.

Several experiments were begun to test this suspicion. It was found at the outset that young seedlings would grow better in pure water, containing no plant nutrients whatever, than in the extract of soil which, though unproductive, lacked in none of the nutrient substances. This result again forced the bureau back to the conclusion that the unproductivity of the soil was due to the presence of a poison. To determine whether the soil was poisoned, lamp-black was mixed with soil extract and filtered off. Wheat seedlings planted in it then grew lustily, though in the same soil previously they had done nothing. Both their top and their root developments were improved astonishingly. The lamp-black added no nutrient to the soil; its sole service was to disinfect.

That these poisons render the soil unproductive, or, to speak more accurately, prevent the full and healthy germination of a seed, the bureau found out, determined their qualities, and identified them. Tyrosin, which is a substance found in green manure, is the name of one of them, and cumarin that of another. It was found that pure water, when impregnated with tyrosin, even to the small degree of 50 parts to a million of water, killed wheat seedlings outright, and that they thrived in the ratio that the quantity of tyrosin was diminished.

The question whether the soil can be cleansed from these poisons in some other way than the use of fertilisers is answered by the American scientists in the affirmative. It can be met by a systematic rotation of crops, and this, they think, is the true remedy.—QUEENSLAND AGRIC. JOURNAL.

INFLUENCE OF THE STATE OF FINENESS OF SUPERPHOSPHATE AND OF BASIC SLAG ON THEIR EFFICIENCY.

J. MIKULOWSKI POMORSKI.

From the time of LIEBIG it has been commonly held that fineness of texture is an important factor in the efficiency of superphosphate. The experiments of P. WAGNER proved how essential was fineness in the case of basic slag, but there is altogether little experimental evidence on the subject, especially with regard to superphosphate; in order to investigate the matter further, two series of culture trials were carried out with oats. The plants were grown in jars containing 13 lb. of a loose soil, deficient in phosphoric acid. For the first year's trial, the superphosphate and basic slag were mixed with 3 per cent. of gypsum used as a cement material, then pounded up and graded by means of sieves into particles of different sizes (0.5-1mm, 1-1.5 mm, 1.5-2mm) while another portion of the mixture was again reduced to a powder. The second season superphosphate alone was tested; it was cemented with agar and reduced to particles 0.5 cc. in size and to a fine powder. The manure was applied in the first series by mixing the dressing with the uppermost third of the soil in the jar, but in the second series the dressing was mixed with the entire contents of the jar. Further tests were carried out with the first series (consisting of 18 units of three jars each) on the effect of adding sodium nitrate and potassic salts; while in the second series (consisting of 8 units) all jars received the additional nitrate and potash.

The results show that superphosphate cemented by gypsum to particles 2 mm in size, or treated with agar, is no less effectual than when in the condition of a fine powder; in fact the samples treated with gypsum sometimes give better results. The depth at which the manure was buried seemed of more importance than its degree of fineness. The phosphoric acid in basic slag, on the other hand was less available when the manure had been treated with gypsum. From these results the following conclusions were drawn:—

(a) It is unnecessary to exact a great degree of fineness in superphosphate, as up to a certain point a rather coarse texture may be an advantage, amongst other reasons because it prevents pasting in the bags.

(b) Superphosphate is far better adapted than basic slag for applying in the furrows together with the seeds at drilling time, as the pasting of the latter is likely to decrease its efficiency.—MONTHLY BULLETIN.

BACILLUS RADICICOLA AND PREPARATIONS FOR SOIL INOCULATION.

L. MAKRINOII.

The writer has subjected to bacteriological analysis the preparations for soil inoculation most widely distributed in Russia. At the same time he tested their effect on plant growth by means of pot cultures.

The bacteriological analyses showed that KUHN's liquid nitragin and BOTTOMLEY's nitrobacterine did not contain the specific organism, *Bacillus radicicola*, while SIMON's "azotogen" and KUHN's "solid" nitragin contained about 50 per cent. of the bacillus amongst a mixed population of micro-organisms.

In the sand cultures the above preparations were compared with pure cultures of *Bacillus radicicola* and with fresh nodules. The best results were obtained with pure cultures, while the "azotogen" and the nitragin, though less effective, gave satisfactory results. The nodules were least effective of all, but even in this case the plants attained a normal development.—MONTHLY BULLETIN.

[This result with nitrobacterine confirms previous examinations by bacteriologists in Italy, Germany, etc.—Ed. T.A.]

A NEW FERTILISER: MOLASSED SUPERPHOSPHATE.

H. STOLTZENBERG.

The residues from the distillation of molasses were at one time thrown away, but they were soon recognized to be of manurial value as they contain nitrogen and potash, and were sold to farmers who applied them to such crops as mangolds, potatoes, tobacco and hops, though their somewhat rapid decomposition and great bulk prevent their being used very extensively. Most of the sugar factories, however, concentrate and ignite their residues to recover the potash, or sell them in a concentrated condition to cyanamide works, which recover not only the potash but also 60 to 70 per cent. of the nitrogen as potassium cyanamide and ammonium chloride. Even in these cases, 30 to 40 per cent. of nitrogen and all the organic matter are lost, and for this reason efforts have repeatedly been made to transform these residues into a solid easily handled manure, either by drying the material or by mixing it with other substances. So far these efforts have proved unsuccessful, as the product has always been hygroscopic.

The reason for this is the presence in the residues of hygroscopic organic bases, more especially of betaine. Now ANDRLIK has shown that the acid phosphate of betaine is not hygroscopic, and the writer obtained a friable, non-hygroscopic product when he treated the concentrated residues from the molasses with a calculated amount of phosphoric acid and then dried the mixture. Better results still were obtained when the residues were mixed with superphosphate and the mixture heated for a short time at 108° C (226° F). The material thus prepared is friable, keeps well and is easy to apply. Molassed superphosphate obtained by mixing 3 parts of superphosphate with $2\frac{1}{2}$ parts of concentrated residues contains 2·25 per cent. of nitrogen, 6·33 per cent. of potash and 11·53 per cent. of citrate-soluble phosphoric acid (8·48 per cent. water soluble), and yields 57·32 per cent of residues on ignition consisting of soluble calcio-potassic phosphate, potassium and sodium sulphate

and chloride, gypsum and non-decomposed phosphate from the superphosphate. The manure is made up of 50 per cent. of soluble substances and of 30 per cent. of undecomposed organic substances. If required, nitrate of soda, sulphate of ammonia or potash salts may be added in order to increase the nitrogen or potash content. The product does not damage sacks and has the advantage over other fertilisers of providing humus material as a basis for bacterial development in the soil.

Attempts to obtain analogous compounds, such as molassed slag or molassed cyanamide, with a preliminary treatment of the residues to render them non-hygroscopic, have not so far yielded practical results.—MONTHLY BULLETIN.

SELECTION AND TREATMENT OF CANE CUTTINGS.

Some practical advice and recommendations are given to planters by MR. J. R. JOHNSTON in Bulletin No 6 of the Experiment Station of the Sugar Producers' Association of Porto Rico, in regard to the selection and treatment of planting material. Many of the points advocated have already from time to time been called attention to by this Department, but in view of the importance of the various points dealt with there would seem to be no harm in reiterating several of the statements.

Where possible several different varieties of cane should be grown on the same estate, and those which prove to be the best should be grown especially for 'seed' with which to supply the plantation. Both immature and mature cane furnish good 'seed', but top 'seed' is better than body 'seed' other things being equal. Cuttings from healthy cane only should be used: especial care being taken to avoid seed from cane affected by the different common diseases.

The average germination of good seed in good seedlings ranges around 50 per cent. of the eyes. In both wet and dry seasons it is much lower. According to this authority, the presence of diseased leaf sheaths on 'seed' does not affect germination nor subsequent growth. The sheath should be removed when (1) mealy bugs are present, and (2) when the 'seed' is to be treated. The chief advantage in using disinfectants is obtained when infected seed is being used or when good seed is being planted under poor conditions. In these cases the employment of disinfectants improves the germination. Treatment of seed to prevent rapid evaporation, and to hasten germination may be desirable but sufficient data is not yet at hand on which to base recommendations.—AGRICULTURAL NEWS.

CO-OPERATIVE CREDIT MOVEMENT.

SOME PROBLEMS CONNECTED WITH CO-OPERATIVE CREDIT SOCIETIES.

BY THE HON. MR. T. B. L. MOONEMALLE, M.L.C.

In the early part of this century there existed in my town a group of young men interested in the well-being of the people. It was my privilege to belong to this group, and one of the problems we had to face was the reluctance of the educated youth to retain his occupation of the land, and to bring his superior intellect to bear upon the methods of efficient production.

We realized on the one hand that the most influential men in progressive countries in the West were those connected with the land ; on the other we were unwillingly compelled to concede that in Ceylon the most influential were those who were either connected with the Government or belonged to one of the so-called learned professions.

We, of course, were prepared to admit that the Government servant and the professional man generally invested their surplus wealth in the land ; but we were also convinced that land development was a profession in itself, and demanded not only a man's best gifts of intellect and culture, but also his whole and undivided attention.

Any compromise in this matter appeared to us as being of no practical value either to the one enterprise or to the other.

As we further investigated the matter we discovered that the real difficulty underlying the question was one of *capital*.

In 1906 the subject of Agricultural Banks came before the public mind.

Having read all the literature available at the moment, I placed before MR. DENHAM, the then Secretary of the Agricultural Society, my views concerning the establishment in this country of Agricultural Banks.

SIR HENRY BLAKE, who presided at one of the meetings of the Society, in referring to these institutions, stated that further investigation would be made before any decisive action was taken.

Five years after, the Co-operative Credit Societies Ordinance was brought before the Legislative Council, and at its second reading the Acting Attorney-General stated that the Ordinance was the outcome of a Committee appointed by SIR HENRY MCCALLUM.

In concluding an able speech, the Attorney-General expressed himself in the following memorable words : "I have no doubt, Sir, that Honourable Members will agree with me that the Ordinance will be of immense benefit to this country ; it may be some time before it is fully appreciated and availed of by the people, but there is no doubt that sooner or later its influence will penetrate into every part of the country, and that it will be an important and potent factor in the amelioration of the conditions of the poorer classes."

The optimism of the Attorney-General seems to have been fully justified by the progress which is being made by the movement, and it is good to learn that, after the appointment of Mr. R. N. Lyne, the Director of Agriculture, as Registrar under the Ordinance, an impetus has been given to the movement, so that at present thirty-seven Societies have been registered in all parts of the Island.

Whilst recognizing the full merit of the Registrar's influence in relation to the establishment of Co-operative Credit Societies, I cannot refrain from expressing my belief that a great deal of the pioneer work has been the outcome of the zeal and devotion displayed by the minor officers of the Department.

The object I have in view in reading this paper is to stimulate inquiry as to the best methods of extending the operation of the Ordinance generally throughout the Island.

So far as I am able to judge, the centres in which Societies have been established are those in which the holdings are entirely under the control of the proprietor, from the first operation connected with cultivation right up to that of harvesting.

To make the point clear : take a district in which the rainfall is both regular and continuous ; all that the agriculturist need do is to watch the season and cultivate his particular product well within the limitation set by prevailing custom. This agriculturist who joins the Co-operative Credit Society at his centre, taking full advantage of the aid provided, brings his cultivation to a successful and profitable termination.

There are, however, districts in which the rainfall is not quite so good and supplies of water are drawn from large or small tanks. Round this system of tanks—whether village tanks or otherwise—a great many customs centred in ancient times.

The central authority in the past was the King, who being possessed of the most arbitrary powers, was generally able to enforce the customary laws in such a way as to secure the highest standard of production.

At the present time we are living under a more enlightened and, consequently, a more liberal administration. Unfortunately the masses being still sunk in ignorance, and drastic powers such as I have described being withdrawn, the village population has adopted an individualistic attitude towards the general community. The result is that unless the preparatory communal work of clearing channels, fencing the common tract against the inroads of cattle, and each landowner accommodating his needs to the needs of the general community are faithfully carried out, a season, however propitious, is bound to terminate in a harvest of failure.

You may ask : Is there no officer who is responsible for the enforcement of these communal duties ? I answer : There is the Vel-Vidane, but he is in no sense better equipped for enforcing them than the villager himself, because, generally speaking, he is as ignorant as the rest of the population.

So far as my experience has gone, the only duty that a Vel-Vidane has efficiently performed has been that of collecting his "suwandiram" at the end of the season's operations.

Another difficulty which has arisen in village life is that, except in very few instances, the settlements are no longer homogeneous. The outsider—whether he be the Moorman or the Tamil settler—has come in and acquired an interest in the village, and is in consequence of his superior claims a menace to the communal instincts of the rest of the community.

The whole question therefore of meeting this difficulty resolves itself into a definite programme of education.

The greybeards in the village need not necessarily go to school. They can be approached by propagandists who know their subject, and be given a clear idea as to the need of combination and co-operation in promoting the best aspects of life in the community, intermingled with a talk on the elementary principles of agricultural science.

Secondly, and I consider this the most important step of all, the children should be taught the simple rules of agricultural science from elementary text books in the vernacular.

Here, too, the great need of combination and co-operation as the outcome of life in the present century should be persistently placed before their impressionable minds.

Not only is our Ordinance framed on the Indian Act No. 10 of 1904, but a great deal of our inspiration for work on the same lines must be drawn from the movement as it has advanced in India to-day.

An Indian writer says: "Co-operative Societies are being established everywhere; co-operative credit has now so far proved its utility."

We also hear of young men of education and influence in that country forming themselves into missionary groups, whose one great aim is to lay before their countrymen the claims of co-operation.

So far my remarks would apply to paddy cultivation.

The product in which I am most interested is the coconut, and the more time I devote to its exploitation, the more I am convinced that every villager can be a man of wealth and influence in his own way, if he will only bestir himself and systematically cultivate his holding with the aid of the capital available to him from a Society of this character.

Manures, implements, and other necessities will be absolutely within his control, the only requisite being a little more enterprise than he has been accustomed to devote towards the furtherance of his own interests.

In a very short time, as the area under cultivation becomes more and more congested, the methods to be followed will have to be *intensive* rather than *extensive*.

It is my opinion that with ten acres of land under coconut and one amunam of paddy, both units being scientifically developed, a man need never despair of occupying a position of affluence and importance in his own community.

The merit of the Ordinance is that it can be applied to all kinds of trades and occupations.

CATTLE.

I have no doubt that the average villager keeps more cattle than he should.

In a herd of from 40 to 50 cattle you can seldom select two good bulls for draught purposes, and hardly any cows for milking.

The cattle are neglected, and are allowed to breed in and in through several generations, so that it would take very little to discover that the ordinary cattle in the villages must long since have degenerated from their original type.

On the other hand, it has been authoritatively stated that Ceylon cattle thrive fairly well on the food supply available, and that the breed cannot be improved without the risk of additional expenditure being incurred in maintaining them.

It is a safe proposition, however, that no man is able or should be encouraged to be nuisance to his more enterprising neighbour who is striving to cultivate the land.

Day by day this trouble is becoming more and more acute ; especially is this indicated by the trend of legislation regarding trespassing cattle.

I believe the time has now come when the villager should turn his thoughts to the selection of the best species available in the country, and breed an indigenous type able to thrive on the limited pasture available and still retain its efficiency for service.

Here, again, if stud bulls were located at different centres in each district, and the people encouraged to bring their cows to be served in return for the payment of a small fee, I think a great deal might be done to educate the villager to the propagation of a restricted number of genuine cattle, rising to a higher standard in type than he is in the habit of raising.

The stud bull may be the property of the Co-operative Society and located in a central spot accessible to all, so that he may serve all the members of the Society resident within a certain radius.

MARKETS.

As the volume of production rises there ought to be provided for the community in a district a central market where produce, cattle, poultry, and commodities of every description might be disposed of.

I believe that there are periodical fairs held in some parts of the Island.

There is extreme necessity for establishing fairs all over the country, to be held at stated and regular intervals ; and I have no doubt that the village producer will thus be liberated from the thraldom of the itinerant trader, who never pays a reasonable price for the articles he collects in the villages, and disposes of in the towns at a profit entirely disproportionate to his outlay of capital.

I have endeavoured to show how some of the obstacles to a wider acceptance of the benefits accruing from these Societies may be eliminated.

Fortunately these Societies are under the management and control of officers of the Department of Agriculture, and if they will exploit the situation with the aid of their unofficial allies, a great deal may be done to extend the influence of Co-operative Societies throughout the land, and we shall in our generation realize that the work, difficult as it may be, is immensely worth the doing.

T. B. L. MOONEMALLE.

April 28th, 1914.

CO-OPERATION.

On our part we have got beyond the stage of considering that the East has nothing to teach the West. We have learned that we have to deal with an agricultural practice which is built on the traditional custom of years and in which reside, though unexpressed and unexplained, deep scientific principles, the reasons for which are only gradually being elucidated. We have found that the only way to progress is sympathetic appreciation of local conditions based on an accurate study of indigenous methods (for which a good knowledge of the language is essential) and a sympathetic co-operation with the cultivator. Unless we have the sympathy and co-operation of the cultivator we can do nothing. Compulsion and force are absolutely opposed to the idea of agricultural development. The adoption of the methods we recommend is a purely optional matter. The cultivator need not take them up unless he wants to : and he certainly will not do so unless he is firmly convinced that they are better than his own. Fortunately we have been able in many cases to persuade him that they are: the days of suspicion and mistrust are gradually passing away and with the cordial and increasing co-operation of the cultivator, I think, we may say that we have really begun to effect something.

Simultaneously with the development of our mutual understanding of each other—that great factor in all schemes of economic development—the co-operative credit movement has been gaining in strength. It provides the lever which lifts the small man out of his narrow and restricted environment and enables him, by the power of combination, to throw off the disabilities of his restricted village commerce and to enter on more equal terms into the business of the wider market places of the world. It is most opportune that the movement should have gained ground in India simultaneously with the forward movement in agricultural research. It is the one great factor which brings the adoption of the most approved methods, expensive though they be, within the reach of the small cultivator who is the backbone of the agricultural wealth of India.

Gentlemen, particularly fortunate and happy are those who, like the members of the Indian Agricultural Service, can take a share, however humble, in the economic development of this great Empire. For a contented and rural population means a satisfied and peace-abiding nation. Yours it is in peculiar measure to work in peaceful harmony and trust with the people amongst whom you are placed: no suspicion or mistrust arises as to the integrity and honesty of your intention: you are working with the people and for the people for the people's good.—SIR JOHN ATKINSON in COIMBATORE CONFERENCE PROCEEDINGS.

ENTOMOLOGY.

THE MANGO WEEVIL.

The Mango Weevil (*Cryptorhynchus mangiferæ* Fab.) is the most destructive insect pest of the mango in Oriental regions.

It is widely distributed, occurring, among other places, in India, Ceylon, Philippines, Madagascar, South Africa and Hawaii.

An inquiry regarding what is in all likelihood this pest has come recently from the Straits Settlements. The correspondent states that in Labuan only about 10 per cent. of the mangoes are fit to eat owing to the fact that the rest of the fruit are found to contain a small brown beetle. He states also that previous to this season mangoes on the mainland at Brunei (about 30 miles from Labuan) were free of this pest.

Mangoes from Jaffna infested with the weevil have reached the office in the course of the year.

From one 'stone' two adult weevils were obtained. The pulp of the fruit was intact but was rotten in some parts. In the side of the 'stone' there was a hole with blackened edges and the contents of the seed were reduced to a black mass of frass.

Weevils were found also in other seeds.

GREEN records having obtained a pupa from the 'stone' of a fruit. It is evident from the above facts that, in Ceylon at least, the insect passes through all its stages, egg, larva and pupa in the seed.

The American Bureau of Entomology has found the same condition of affairs to prevail.

In a circular calling attention to the danger of introducing the Mango Weevil into Florida, where a mango industry is springing up, it is stated :—

"The egg is deposited in the fleshy part of the fruit and the young grub burrows at once into the seed pod and develops in the seed to a pupa and finally to the adult."

LEFROY, however, in INDIAN INSECT LIFE, states that the insect pupates in the soil.

Under the former condition a much better opportunity is afforded of collecting and destroying the insects, as they remain for a time in the seed even as adults, whereas in the latter case control would be much more difficult as fallen fruits would probably soon be deserted by the larvæ.

At the same time this habit of remaining in the seed during all of its stages brings about a much greater degree of danger of the insect being distributed from place to place with seed.

And doubtless this explains how the weevil has come to be present in practically all mango regions.

It was found in the United States that shipments of mango seeds coming into the country were largely infested with the weevil.

The American Bureau of Entomology further found that it was not possible to destroy the insect in the seed by fumigation with any certainty, and the only remedy they were able to advise was to collect and destroy all of the fallen fruit and the fruit that on examination was found to be infested.

The only means of determining infestation is to open the seedpod and remove the paper-like covering of the seed, when the work of the insect can be noted.

As a further precaution all apparently sound seeds should be germinated under a wire screen, so that weevils that may have been overlooked shall not be allowed to escape.

It should be possible by sustained and collective work to reduce the injury due to this pest to a minimum.

It is a source of encouragement to know that this weevil is specific on mangoes, no other food plant being known.

Perhaps a spraying at intervals with arsenate of lead at a strength of 2 lb. to 50 gallons of water would be an additional means of control. It might deter the weevils from egg laying, and, if it should be their habit to feed on the trees on which they lay their eggs, as is the habit of many weevils, they would thus be poisoned.

The weevil is about $\frac{1}{3}$ in. long.

It is greyish-purple in colour with an indefinite but distinct black area in the mid-dorsal region.

The thorax is tubercled, the elytra punctured and tubercled. The rostrum fits into a groove and reaches to level of the middle coxæ.

A. RUTHERFORD.

THE BEAN FLY (AGROMYZA PHASEOLI, Coq).

In Ceylon beans are subject to the attack of a small, black fly (*Agromyza phaseoli*, Coq). When this pest is present the crop is often a complete failure. A recent correspondent informed me that out of over 600 seeds planted, only 20 plants were obtained ; this plant was identified as *Vigna sinensis*, (*Me-karal*, *Wanduru-me*, (*Sing.*) *Cherry Bean*).

Another correspondent sending beans that had been killed said that his peas also were attacked.

The same species of fly is a very serious pest of French beans in Australia. It was from specimens sent him by Mr. Froggatt, Government Entomologist of New South Wales, that Coquillet described the insect.

That was in 1898 or 1899.

The first record of its presence in Ceylon that I can find refers to the year 1901 when Mr. Green observed it at Peradeniya. It is regarded by Froggatt as an insect native to Australia, though in 1911 no native host-plant had been discovered. In Australia it attacks also Lima and Madagascar beans, Cowpeas, Phaseolus sp.

At Peradeniya I have reared it from Green Gram and Black Gram.

Green Gram was attacked in a worse degree than Black Gram though they were growing in neighbouring plots.

FLETCHER lists an *Agromyza* as a major pest of young plants of Cowpea, Lablab and Green Gram, and another as a minor pest of Red Gram, in South India,

It is not improbable that at least the former of the two is *Agromyza phaseoli*, Coq.

Infested bean-plants are wilted.

The lower part of the stem is brown in colour, swollen and cracked. The tissues below the bark have been eaten away. In the empty spaces below the bark the brown puparia, the resting stage of the fly, chiefly lie.

Bnt they are to be found also in the centre of the stem and in the leaf-stalks.

The nodes of joints are also subject to attack, in which case they too are brown, swollen and cracked.

The maggots which are the direct agents of the injury are to be found chiefly towards the limits of the damaged portions, where the tissue is fresher.

They are yellowish-white in colour and taper towards each end.

They bear a pair of processes at each end, the anterior pair being situated on the dorsum somewhat caudad of the anterior end.

On the dorsum near the anterior end is a small, soft, translucent process which is retracted along with the head region.

Mouth hooks are present.

The puparium, which is more conspicuous than the maggot, is about 1-12th of an inch long.

It is brownish. shining and much darker at the ends than in the middle.

At each end, as in the larva, there are two short processes. The anterior ones are slightly knobbed at the apex ; the posterior ones are bifurcate at the apex.

Under the microscope eight transverse bands of brownish spots, one situated at the posterior limit of each of eight segments, can be plainly seen.

The adult fly is slightly less than 1-16th of an inch in length.

In shape it is like a small house-fly. It is bluish-black and glossy and very active.

The wings are whitish and the veins, except the costal, rather faint.

There is a distinct notch in the costal region where the first vein reaches it.

The distance from the point where the cross vein (r—m) meets the vein M (1 by 2, 4th vein) to the point where the cross-vein (m) meets this vein is distinctly greater than the length of (r—m), and is almost if not quite equal to twice the length of (r—m).

It has been recorded from Koslanda, Peradeniya and Trincomalee.

I have bred several species of Hymenopterous parasites, Chalcids, from infested material. While they no doubt do a considerable amount of good, they had not been able, in the cases which came under my observation, to keep the fly in check.

In an article by E. JARVIS in the QUEENSLAND AGRICULTURAL JOURNAL of February and March, 1913, it is stated that the eggs are laid in the leaves and that the maggots tunnel down the leaf-stalk to the stem.

The following methods of control are there suggested :—

(1) Root up and burn all bean plants immediately they have ceased to be profitable.

[This procedure has the drawback of destroying at the same time any parasites of the fly that may be present. The flies are so small that it would be difficult to place the material in a cage that would permit the parasites to escape, while retaining the flies. But a cage provided with a covering of fine muslin would probably meet the case.]

(2) Protect the stems by hilling them up with soil. Sydney market gardeners are said to adopt this plan, which in good growing weather, enables a damaged plant to root afresh above the injured portion.

(3) Grow beans in a shallow trench and apply to the soil (so as not to touch the plants) whitewash made from acetylene refuse or lime slaked with water containing carbolic acid or phenyl.

(4) Stretch three or four lengths of packing twine over a row of beans close to the upper leaves having first dipped the string in some attractive sticky solution (a sticky solution may be made by dissolving $\frac{1}{2}$ lb. of resin in $1\frac{3}{4}$ pints of castor oil ; sugar being added to sweeten it).

A. RUTHERFORD.

RAINFALL FOR MARCH, 1914.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	3·80	8·07	Kurunegala	7·00	2·85
Kandy	6·62	3·28	Batticaloa	3·16	0·35
Galle	2·02	4·73	Badulla	4·14	3·15
Jaffna	0·22	0·14	Ratnapura	6·80	6·74
Anuradhapura	3·31	1·35	Nuwara Eliya	3·01	3·20

POULTRY.

QUALITY AS A FACTOR IN PRODUCTION.

J. HADLINGTON.

Perhaps the most prominent feature of modern poultry-keeping is the amount of concentration of thought and effort on the attainment of the highest possible productiveness from our feathered flocks. Undoubtedly our laying competitions have been the means by which this idea has found expression and stimulation, the influence of which will be felt for all time, and far beyond the confines of Australasia. Another feature, too, is that they have dispelled the illusion that existed in the minds of farmers and utility men in general, that crossbred or mongrel poultry of any kind were preferable to pure breeds. This in itself has opened up a new chapter in poultry-keeping and lifted poultry culture to a higher plane upon a scientific basis, demonstrating what is possible with pure breeds, and at the same time making it clear that upon no other basis could anything like uniform results be obtained. So much is now admitted on all hands. But there is still one other matter of very vital importance upon which, in my opinion, we need equal effort and concentration. It may fairly be questioned, are our laudable efforts in the matter of production being followed up in due proportion in the direction of the maintenance and improvement of quality? If they are not, then I fear we shall soon lose ground in our other attainments. My contact with utility breeders leads me to the conclusion that there is a tendency to be satisfied with too low a standard of excellence. On every hand one is met with the almost stereotyped assertion that not quality, but productiveness, is wanted; in fact, quality would seem to be at a discount among utility men—at any rate among beginners. This would appear to indicate that we are in some danger of overlooking the standard of quality necessary to the maintenance of the production we are aiming at.

To get a clear conception of what is here meant by quality, it is necessary to refer to the breeds everywhere acknowledged as utility fowls, such as Leghorns, Orpingtons, Wyandottes and Plymouth Rocks. Each breed has distinctive type and characteristics of its own, and to have an identity this type must be preserved in its entirety; to get away from it is to merge into nondescript. The standards of perfection as set out for each breed are such that, with slight exception in regard to colour and markings, would be in conformity with what the experienced utility breeder would consider essential to his requirements. And as a matter of fact, most, if not all, of these breeds have been evolved with the special object of filling utility requirements, the fancier having come into the piece as a developer of exaggerations, such as length of leg, size of lobe, comb, etc. But in essentials such as type, symmetry, and proportion, the fancier and utility breeder are

on common ground. These are the main points that concern us, and without conformity to the standards in these particulars, the breeds would lose their identity. And largely in proportion as our birds do conform to standard requirements in these particulars are they likely to retain or develop those traits for which each breed stands.

Last but not least comes the question of development in our growing stock. This is a feature of quality which has a very important bearing upon their productiveness. None of these points can a fancier afford to lose sight of ; neither can we as utility men, if we are to succeed and carry through to perpetuation the grand breeds of fowls we are now working upon, and which have cost much thought, time, and money to bring to their present state of perfection.

It is not here contended that because a fowl conforms to all these requirements it will necessarily be a champion layer. Although my experience is, that there is nothing incompatible in this regard, it is the chief business of the utility breeder to develop the laying instinct, just as it is the aim of the fancier to develop quality in other points. But what is contended is this : that type, symmetry, and proportion is the foundation upon which all else is built. This brings us to a review of present-day conditions in regard to what is styled fancy and utility considerations. That the fancy poultry idea is on the wane, and in fact almost extinct, is evidenced by the lack of interest in our poultry shows. Very few people now keep fowls purely as a hobby ; the commercial side of poulty-keeping has taken hold of the poultry man to an extent never perhaps known before. But in this we are losing the skill and enthusiasm of the fancier in maintaining high ideals. This in turn has sounded the death-knell of many old favourite and fancy breeds, and has narrowed down the displays at our shows to practically a few breeds. This, to my idea, is a clear gain from a commercial point of view, but it has brought with it a new responsibility to the utility breeder—the responsibility of maintaining the respective breeds up to their best features and traditions. It therefore devolves upon us as breeders, to take a keener interest in the preservation of the breeds we are using, and to make some effort to educate our new beginners in the poultry business up to standard requirements, in so far as it affects utility interests. This could be best accomplished by a closer study of the standards set up for each breed we are handling, with a view to making the utility voice heard when departures from standards as they affect us are creeping in.

We have no better illustration of this than in our present-day White Leghorn. The prominence that this breed has attained as a layer has actually had a modifying effect upon the style of that breed now being exhibited at our shows, and yet no alteration of the standard has taken place, but only a more rational idea in its interpretation. The standard was right all the time, but the departures from it were in the nature of exaggerations without any useful purpose, and to obtain which other good qualities were often sacrificed, and questionable methods of breeding resorted to. The remedy for this state of things, in my opinion, lies in the direction of utility breeders taking more interest in our shows, studying the standards, and coming into contact with fanciers and stud breeders, whereby an interchange

of ideas would help to mould the thought and practices in connection therewith, as their interests are every day becoming more and more identical. We should then have the skill of the fancier and the practical commercial ideas of the utility breeder combined in mutual interest, resulting in an all-round improvement, and giving an impetus to poultry-keeping both for profit and pleasure.

I have never had any sympathy with the idea of one type of the same fowl for show ,and another for utility, but type should not be confused with strain. There may be many strains of the same breed, all displaying some variations in character, yet they should be all one type.—FARMERS' BULLETIN, N. S. W.

REARING DUCKS IN THE PHILIPPINES.

When the ducklings are only two or three days old they are divided, the males from the females. The most of the males are sold, either immediately to people who make a business of rearing them for the market or directly to the market when they are four to six months old. The ducks which are to be kept are put into groups of about 500 each, 50 males and 450 females. Each of these groups is put into a big bamboo basket two or three meters in diameter and three or four decimeters high. The bottom of the basket is covered with dry straw to keep the ducklings warm. On sunshiny mornings the ducks are taken out and the little birds are given a sun bath. They are fed with the larva, pupa, and adult of an insect locally known as "gamo-gamo" when adult, or as "bahay-uod" in the larval and pupal forms. The "gamo-gamo" is common in bamboo groves during dry weather, and the "bahay-uod" is taken from the bottom of the lake. Boiled rice is also given to the young ducks, but care is taken not to over-feed them. When the insects are not available, small shrimps are minced and fed with the rice. Five days after the ducklings are put in baskets, their normal diet is changed to shrimps and boiled rice, given three times a day. When they are about a month old, they are turned loose in small bamboo pens, each of about 12 sq. m. Each of these pens connects with a shed of the same size. In these pens they are fed on unhulled rice (palay), and on clams or snails from which the shells have been pounded off.

When the ducks are four months old, they are put into larger pens each of which is five meters wide, and has a length of eight meters, half of which is on the land and half in the river. Each pen also connects with a shed five meters wide and six meters long. The floor of the shed or dormitory is covered with rice hulls to keep it warm and dry. From time to time this bedding is removed, with the droppings of the ducks, and sold for a fertilizer to the growers of betel leaf. The ducks in these pens are fed twice a day with a basket of mollusks containing all they want, and once a day with a ration of five liters of rice. If they are well cared for, the ducks begin to lay after four months in these pens, but if they are not properly treated, it may be nine or ten months before laying eggs.

The adult ducks have the same care as those somewhat younger. They may be left in the same pens, but it is considered better treatment to put them into large enclosures and to have fewer ducks in a group.

INCUBATION.

The object of the duck and egg business in Pateros is the production of "balut" or eggs which have been partly incubated and are sold and eaten in this condition. As the ducks are non-setters, incubation has to be artificial, and is carried on in houses known as "balutan" constructed for this purpose. The building itself is a low one with bamboo walls and a nipa roof. The eggs are placed in deep cylindrical baskets. Each cylinder is 18 inches in diameter and 24 inches deep. These are arranged in two ways. The less common way is to have a single row along the wall ; this arrangement is called "panabi." The more common arrangement called "de cajon," is to have a double row in a long box which is placed in the middle of the house. This box is made of bamboo or of wood and is made with tight sides and with a bamboo floor or on the ground. The bottom is then covered 10 cm. deep with firmly tamped rice hulls. The cylinders, called "toong," are then put in position on this body of hulls. If the arrangement is "de cajon," the cylinders are five inches apart and four inches from the sides of the box. After the cylinders have been put in place, the box is filled full around them with rice hulls so that it gives the appearance of a table with two rows of wells in it. The entire floor of the building is also covered three or four inches deep with well tamped hulls, which are said to serve to keep it dry and uniformly warm. The roof of the building is fitted with ventilators which can be opened and shut with levers.

The eggs come to the building in "kaeng" or baskets made to hold 500 eggs each. The first thing done with the eggs is to separate out all which have thin shells. This is done either by snapping the eggs with the finger, hard enough to break thin-shelled ones, or by looking through an egg tester. The latter consists of a hole through a board : eggs with thick shells can be distinguished by their dark colour. Thin-shelled eggs whether cracked or not are immediately marketed as fresh eggs ; the subsequent treatment demands thick shells in order to avoid breaking.

The selected eggs—that is, thick-shelled ones—are then placed in the sun and allowed to heat until they become moist. If there is no sunshine, the eggs are put immediately into the "toong" and heated with palay. For this purpose the palay is heated in an iron cauldron until too hot for the hand.

Assuming that the initial heating has been in the snnshine, the eggs are then put 125 together on a piece of coarse abaca cloth about 90 cm. sq., and the corners of the cloth are then tied tightly together forming a sack. Five liters of palay at a temperature of 32 to 34 degrees are then tied into a similar sack and placed in the bottom of a cylinder. On this is placed a sack of eggs. Alternate layers are put in until there are eight layers of eggs. Over the last layer of eggs are placed two layers of the palay.

When the eggs have been incubated in this way for about five days, they are put into other cylinders in combination with fresh eggs, for the purpose of heating the fresh ones. If this were not done, the temperature of the eggs left to incubate altogether would rise sufficiently to kill the germs. Accordingly, if fresh eggs are not available it is necessary to take the old ones out of the cylinders to cool for a time in the air. The combination of eggs of different degrees of incubation is called "lansacan." The arrangement is as

follows :—At the bottom of the cylinder is placed a layer of rice as already described. On this are placed two layers of the five day old eggs. On this is another layer of rice ; then two layers of new eggs ; then a layer of rice : then two layers of five day old eggs ; another layer of rice : and two more layers of old eggs, and finally on top two layers of rice and a thick sack. In each cylinder there are then six layers of five day old eggs, two layers of new eggs and six layers of rice.

This is only the first step in this treatment. For as soon as the house comes to contain a variety of eggs of different stages the bottom layers will be thirteen days old, the next two layers nine, the third two five, and the top ones seventeen days old. During the dry season the eggs are transferred from one cylinder to another every day, and during the wet season twice daily. The seventeen-day old eggs are always kept on top and are accordingly there on the 18th or 19th day, at which time they are ready to be marketed as "balut." The shifting of the eggs, done daily or twice daily according to the weather, must be done by very skilful operators, or an unnecessary number of eggs will be spoiled. In this operation the rice sacks are lifted from the cylinder and tightened until instead of being flat they are spherical, and put down with the knot on the under side. The egg sack is grasped by the intersection of the corners, lifted a little, and turned in a circle until all the eggs are collected in the middle ; it is then lifted from the cylinder and transferred to the other. The eggs which were before toward the middle of the box are now placed on the outside. This is because the part of the cylinder which is toward the outside of the box is slightly cooler, and by changing the position of the eggs all of them, day in and day out, are kept at practically the same temperature.

During cold weather the rice is warmed in an iron cauldron which fits the top of a stone fire place. It is heated to 36 to 37 degrees C., and immediately put into the abaca sacks and carried to the incubator and piled in sacks. The rice for this purpose is used over and over and lasts for two years or more.

EGG TESTING.

When the eggs have been incubated for thirteen days, they are tested as to fertility. This is done by the usual method, that is by looking through them at the light and turning them. Those which are infertile are sold immediately under the name of "penoy." Their price is P. 25·00 a thousand. About 10 per cent. of the eggs are usually penoy, but the proportion may run as high as 50 per cent.—Philippine Agriculturist & Forester.

LOCAL NOTES.

POULTRY-KEEPING IN CEYLON.

To the Hon. Editorial Secretary,

Ceylon Poultry Club Magazine.

Sir,

There must be many members of the Club who keep poultry, and are no doubt very keen on this pastime and yet know very little about the matter, and are probably not getting results equal to the money they spend.

Now, poultry keeping pays in Ceylon and pays well, if the birds are properly looked after, and there is no doubt every bungalow in the Island should have a poultry run. It is part of the work of the Hon. Secretary of the Ceylon Poultry Club to help members who require help and this the Secretary will be only too pleased to do, if members will write to him.

Yours, etc.,
C. W. JONES,
Hon. Secretary and Treasurer.

24/3/14.

C. P. C. MAGAZINE.

The Hon. Editorial Secretary,
Ceylon Poultry Club Magazine.

Sir,

I should like to inform all members of the Club that owing to constant complaints "that the Magazine has not been received" I have instructed the printers to send all Magazines to me, and in future I will post them off to members myself, thus making absolutely certain that there will be no cause for complaint in future. At the same time let me point out that Magazines will only be sent to members who have paid their subscriptions for the current year. At the present moment, 24/3/14, 66 members have paid, leaving another 35 unpaid subscriptions. In some cases I have written three or four times requesting payment, receiving no reply, and I regret to say one or two of our well-known members are among the non-payers. I would like to point out that the Club is run on a very low subscription and Rs. 359 outstanding is a large sum for the Club to stand, and also that constant writing to members for their subscriptions costs money in stationery and stamps, to say nothing of the Hon. Secretary's time.

Yours, etc.,
C. W. JONES,
Hon. Secretary and Treasurer.

PRIZES AT POULTRY SHOWS.

The Hon. Editorial Secretary,
Ceylon Poultry Club Magazine.

Sir,

I should like to propose that at our next Committee Meeting the Secretary brings up the following proposal :—

That instead of giving a special for the Best Imported Cock and another for the best imported Hen, that these two Cups be given

(1) for the Best Imported Cock or Hen, Heavy breeds
(2) ,, ,, ,, ,, Light ,,

All Exhibitors are not millionaires and cannot afford £15 to £25 for importing winners out of the classical shows at home. To import a really good winner of any heavy breed a high price must be paid, whereas for £3 to £5 a very

good specimen of any light breed can be purchased. When in England in 1911, I purchased from perhaps the best known Leghorn breeder and judge a pullet that had swept the board at the Tunbridge Wells Show, winning every special given for Leghorns and Light Breeds. For this pullet I paid £2 10s. An Orpington that had won at that Show could not have been purchased under £15, and that is why I say—Let the poorer members have a look in, and let the specials be given as stated above. I write this letter BEFORE the Show.

Yours, etc.,
F. J. REISS,

10/4/14.

THE CHICKENS.

Chickens when a few days old require grass, or its equivalent. Those poultry-keepers who have a lawn or grass plot should coop their chicks on it. Never mind what the neighbours say—it happens to be your affair, not theirs.

If a chicken twenty-four hours old cannot thrive in the open with its mother or foster-mother, put it out of its misery. In breeding fancy stock it may "pay" to coddle chicks ; but where perfection in bone, muscle, and flesh is required, it does not pay to rear invalids.

It is a wise plan to have a stock of chicken meal to break the monotony of "egg and breadcrumbs." The chick wants a change after taking up nearly the whole of the yolk of the egg from which it was hatched.

Of all things in the usual menu for chickens' breakfast there is nothing to compare with warm, almost hot, milk. To see some fifty chicks partaking of this beverage just at dawn, one would suppose that grace before and after meals was not sufficient in chickendom. The general expression of satisfaction in a chicken when it has got a fair start into this warm drink rivals that of a city alderman when engaged on his turtle soup.

When hatching by hens, it will be found that it will pay to see that the bird is strong and vigorous, the nest absolutely clean, and the eggs reasonably fresh. Also, arrangements should be made to permit of the hen coming off whenever she wishes for food and water. Needless to say, the quieter the spot the better.—POULTRY FARMER.

GIVE MEAT TO LAYERS.

Meat is highly nitrogenous, and supplies the hens with elements that are lacking in grain. Meat will cost little compared with the increased number of eggs that may be secured. When only grain is allowed the hens they will be unable to convert it into eggs unless "balanced" by foods of a more nitrogenous character. Although the price of meat is apparently high, yet one extra egg a week from each hen will be sufficient to pay for the luxury afforded them.—POULTRY FARMER.

THE INTENSIVE POULTRY KEEPER'S GUIDE.

GEORGE DENT.

Feeding is one of the most important factors of success in poultry-keeping, especially with intensively kept birds. Fowls that have broad acres at their disposal have a good opportunity to pick and choose where they like ; but those in confined quarters have to live on what the owner gives them. It will be seen, therefore, that judicious feeding is alsolutely necessary for profitable productiveness with intensive poultry keeping.

The food given to birds in the mash, either dry or moist, must be both bulky and nutritious. At the same time it must be easily and quickly assimilated, so that the birds are kept busy scratching for the grain or split maize, which should be buried in the scratching litter or earth. If birds are given the more concentrated foods on the intensive system many vices and ailments may be looked for, as the fowls get idle, and with idleness indigestion sets in; also the birds become victims to feather eating. With good judgment on the part of the feeder birds can be kept busy all day long, and yet obtain sufficient nutriment for their bodily needs, as well as a little overplus for the manufacture of eggs.

KEEP THE BIRDS SCRATCHING.

Busy hens do not need half the attention as do idle ones, nor do they contract diseases so quickly. Scratching is a great health-giver, and it is therefore important that the foods given in the form of mashes are not too starchy or indigestible. In winter birds need more concentrated food than in summer, although ninety per cent. of poultry keepers give the same ratio in summer as in winter.

CHANGE THE FOOD.

As the English climate is so changeable I feed accordingly, having a good variety of foods in stock to choose from. As a suggestion: If a cold spell sets in I give more concentrated foods, such as maize meal, a little pea or bean meal, or more meat or fish meal in the birds' mash; while in the warmer weather I give plenty of broad or flake bran and lawn clippings in the mash. By so doing I cater for the extra bodily heat required in winter and prevent overheating in the warmer weather.

SPROUTED OATS AND OTHER GRAINS.

Sprouted Oats, wheat, rye and even peas cannot be over-estimated for either intensive poultry keeping or any method of feeding or keeping birds. I have always found that when I have cut off the supply of sprouted grain the egg yield has diminished. As we give sprouted oats as an egg-producer rather than as a green food, it will be perhaps as well to state that I consider it economy to feed sprouted grain with sprouts $\frac{3}{4}$in. and 1in. in length. I do not see the economy of giving oats with sprouts 2 or 3 inches long as a green food.

By experimenting I have found that by supplying the grains while the sprout is short I not only retain but increase the nutriment; as well as obtaining three times the amount of food. On the other hand, if the sprout is

allowed to grow into a blade the nutriment of the grain is lost, and one might as well give grass. Green food is absolutely necessary, but can be obtained much cheaper than by converting oats to use for that purpose.

Both adult birds and chickens will eat sprouted grain in preference to any other food, and as it is very rich in albuminoids, yet quickly digested, it is one of the cheapest foods on the market when oats are about 1*s*. per stone. You cannot obtain a cheap and at the same time nutritious food at 4*d*. per stone by sprouting them. I give both chicks and adult fowls as much sprouted grain as they will eat, and by feeding while the sprouts are short, it is not necessary to chop them up before supplying. As a first feed in the morning I find it cannot be excelled. Being easily assimilated the birds are ready for the scratch feed early in the forenoon.

QUICK SPROUTING NECESSARY.

Grains that have taken a long while to sprout are not to be compared with those which have been forced to sprout quickly, as the former have lost nutriment through too much root formation, to say nothing of the slight mustiness, which increases according to the period in sprouting. If the grain is sprouted in three or four days it has very little root and is very sweet and nutritious.

ONCE USED ALWAYS USED.

After sprouted grain feeding has once had a good trial it is very rare that the feeder is induced to leave this valuable food out of his daily rations. By spending less than ten minutes daily a poultry-keeper can sprout sufficient grain for 600 to 800 birds. It will thus be seen that the time and labour are well and profitably spent in grain sprouting.

THE KIND CHICKENS PREFER.

While I have found that sprouted oats and rye are liked best by adult birds, chicks prefer sprouted wheat. But at the same time it will be found that oats and rye sprout the quickest. No intensivist should be without sprouted grain, either for raising chicks or for producing eggs.—Poultry Farmer.

BAOBAB FRUITS AND SEEDS FROM THE EAST AFRICAN PROTECTORATE.

The low oil content of baobab seeds does not allow them to be exported to Europe, but they can be used on the spot as food for live stock by softening the integument by boiling. They contain 3·5 per cent. of mineral matter, and their ash, which is rich in potash (31 per cent.) and in phosphorus pentoxide (34·2 per cent.), may be utilised as manure.

The husk of the fruit may be used as fuel, and its ash is a rich potash manure (47 per cent. of potash).

Though the pulp contains a certain amount of free citric acid, the extraction of this is not remunerative on account of the presence of a good deal of pectic substances. The pulp does not seem to be utilizable beyond the colony, where it is used to coagulate rubber.—Monthly Bulletin.

GENERAL.

RESEARCH, EXPERIMENT AND DEMONSTRATION.

(*Continued from page 351.*)

Facts differ widely in their importance. We must be sure in the first place that what we determine is actually a fact of a permanent character, and not merely the result of a particular combination of circumstances that might never occur again. This means a greater refinement of method than is usual in the common field and feeding experiment, a provision of methods and checks which will bring conditions more largely under control. But among established facts some are pregnant and others sterile, some have no reach—they teach us nothing beyond themselves, and the scientist who has ascertained them has not become more capable of foreseeing other new facts. On the other hand, there are facts of great yield; each of them marks a definite contribution or step in advance and foreshadows the way for further progress. Isolated facts in agriculture do not always have the constructive value that such facts may have in a pure science, because the investigator is sceptical of them, knowing the liability to faulty observation.

FACTS.

Some have contended that all facts are contributions to knowledge, and that as research depends on the determination of facts the counting of the blades of grass on a plat or the leaves on a tree, wholly apart from any further connection, is research. The results are new facts which apply to the particular case in question, but such facts of themselves have no reach or significance, no permanent value, and represent only routine activity. Their determination does not form the part of a plan or supply a link in a theory, and is not guided by any scientific purpose. No matter how scientifically accurate such facts may be their determination manifestly is not what we understand by research, In much the same way, the making of analyses is in itself not research, although it may be important to that end. Without a guiding purpose that leads beyond the mere determinations they represent routine work. In research the determination of facts is guided by a purpose and aim, and implies a use.

The cataloguing of isolated facts without deducing from them their causes or consequences or relations is not to be classed as research. Merely to observe is not sufficient. The observations must be used. We cannot be content with the bare facts of the experiment. To do so would be to mistake the true nature of science. Isolated facts have little scientific value until they are arranged and correlated. The scientist must set in order. "Science is built up with facts, as a house is with stones. But a collection of facts is no more science than a heap of stones is a house."

Underlying all research is a definite purpose, a problem which the investigator aims to solve by the marshalling of experimental facts and observations, and their interpretation. Research, therefore, is directed in its selection or determination of facts. We cannot know all facts and hence it is necessary to choose those which are worthy of being known, and which for the time being meet the special needs of our investigation. Hence, also,

observation and experiment should not be allowed to run wild, to wander wherever the facts may lead, but directed for the time being to the special problem under investigation. Fugitive effort accomplishes little.

The choice of facts is a large element in the method of science. Research advances by a procession of experiments skilfully and intelligently planned to supply the needed facts. Experiments are not made at random or by chance or to see what will happen, if they form a part of research, but advisedly, as a means to an end, and as an outgrowth of the working plan or of what previous experiments have suggested. They are devised for a definite purpose, and in the belief that they will yield the facts needed. It is a part of the function of the skilled investigator to devise ways of getting at the facts needed for his problem.

In pure science certain facts are considered more interesting than others because they complete an unfinished harmony, or because they make one foresee a greater number of other facts. "Above all the scientist must foresee." The securing of facts of such reach that they enable many others to be foreseen is one conception of fundamental research, as it is justification of "science for science's sake."

"The most interesting facts are those which may serve many times; these are the facts which have a chance of coming up again." They are the simple facts rather than the complex. As the biologist studies the cell rather than the whole animal, the investigator in any branch of agriculture must resolve his subject, which is always complex, into the simple factors that comprise it. The difficulty lies in this analysis. Too often what are really lines of work rather than integral phases have been the subjects of study Cheese making, for example, is not a project for investigation but a line of study. So long as the experiments related to the process as a whole instead of to particular aspects of it little more resulted than poorly understood rules. How little we knew about the actual importance of various operations in cheese making until many, many detailed studies of small factors in the various stages of the process enabled the real and essential facts to be separated out from the dogmatic rules, and these facts to be classified and arranged into a system of relations that has given a science of cheese making

THEORY.

Having selected a definite restricted problem, a theory or hypothesis is essential for outlining the plan of attack, as a starting point and as a guide in the conduct of the investigation. We often hear reference to the danger of a preconceived idea. It is not unscientific to have a quite definite preconceived notion, provided it is not allowed to control and bias the investigator. On the contrary, all research implies hypothesis, for it is an accepted axiom of science that "without hypothesis, no science."

"Hypothesis has a necessary role that no one has ever contested. Only it ought always as soon as possible and as often as possible to be subjected to verification. And of course, if it does not stand this test it ought to be abandoned without reserve." The danger of hypotheses lies in making them unconsciously or without proper foundation, in accepting them as truth, and in clinging to them in spite of evidence. This danger is far greater in biological sciences which enter into agricultural investigation than in those having the precision of mathematics and capable of proof. The discarded hypothesis is not barren, for it has given a negative result and led to the opportunity for discovery. Without the hypothesis the experiment would have been mere chance, and hence have been lost because of the inability of the observer to see anything extraordinary in it. But essential and helpful as is hypothesis, experiment is, in the subjects with which agricultural research deals, the sole source of truth. It alone can teach us anything new; it alone can give us certainty.

Success in research depends not alone on skill and ingenuity in planning experiments, but on foresight in generalizing from the facts secured. The scientist must be able to look beyond what the bare facts demonstrate, and to derive suggestions from them. A good experiment has been defined as one which informs us of something besides an isolated fact, which enables us to foresee through generalization. For without generalization knowledge is impossible.

Aside from its own intrinsic value each demonstrated fact enables the investigator to foresee other apparent facts, the essential features of which must be verified by experiment at the first opportunity, but which in the meantime enable further foresight, although without absolute certainty. As experiments are time-consuming, knowledge can never be fully supported on verified experiments, hence it is necessary to get the utmost possible number of predictions from every experiment, and with the highest possible degree of probability. Generalization must be directed in such a manner as to increase "the yield of science."

"Knowledge is not a gift of bare experience nor even made solely out of experience." The creative activity of the mind is an important essential in its derivation. We report facts, and we say we let them speak for themselves. But as we investigate we inevitably interpret the results as well as record them. Research leads outside the field of human experience and beyond experiment, and through constructive reasoning extends the boundaries of knowledge.

RESEARCH.

These things point to the necessity for reflection in productive research. The experiment is only a means to an end; the fact in and of itself may be barren if merely observed and chronicled. It is the skill and foresight of the investigator in deriving his facts, and the use which he is capable of making of these facts in seeing relations which are not obvious to the layman, supporting and developing his hypothesis, and guiding his further experiments. That determines his research ability. The unreasoning making of experiment bears no stamp of originality, leads nowhere except by the sheerest chance, and is not of the nature of research. It is what the scientist puts into the contemplation of the facts, the point of view they give him, and the further plans they suggest to his mind that make them virile.

This means that the investigator must be a student as well as an experimenter, must study his results critically to determine their true significance and relationship and reach, and interpret them in their bearing on his hypothesis. Unless he can take the time for this he will often miss the significant points in his experiments, will not be guided by what has gone before, and his investigation will devolve into a round of routine.

In a word, then, research advances by a procession of experiments and observations, based on hypothesis and guided by the foresight which generalization supplies. Science prospers through empirical discoveries, and the theory must not run counter to any positive empirical facts; but science does not stop with their determination. It demands the reason, the connection, the law. These are derived through induction from facts developed by experiment which support the theory or the principle or the conclusion at essential points. Without these steps research lacks the essential features. This is as true in agriculture as in any primary science.

But research is not the sole source of knowledge and there are many additions to knowledge of a sound, scientific character, whose derivation does not seem to answer the definition of research. Among such are discoveries made perhaps by chance observation, or the recognition of a fact in an experiment, possibly in the course of research but not an outgrowth of it. These may have all the weight of scientific facts, constitute contributions to science, and be strictly original, but still not represent research. This makes them no less valuable or dignified.

Research carries the idea of a protracted inquiry; it is a conscious, premeditated effort in the working out of problems usually not solved by a single experiment, but requiring progressive study through a series of experiments from which the answer is gradually evolved. If we are to accept the definition of the sciences, agricultural research is to be understood as an excursion into the unknown, involving a combination of various types of effort—hypothesis, experiment, generalization.

It will be recognised that in contrast to research, what in agriculture we commonly designate as "experiments" are much simpler in their aim and plan, and lack the finality of research. They are usually satisfied with the empirical result. They may not even be original, for many experiments aim merely to test out or adapt the conclusions from former work to a new locality or a new set of conditions. They may not even be scientific in the sense that they seek strictly scientific facts, but they should be made with the care and precision of science. Such are many of the commercial experiments, to determine economical methods of practice or relative values. Usually the results are of a more or less temporary nature.

EXPERIMENTS.

A large share of the ordinary field and feeding experiments are comparative trials rather than strictly scientific investigations. They are made under presumably quite uniform conditions, and hence the results of the comparisons in a given experiment are fairly comparable one with another, but not directly comparable with those in other trials, where the combination must necessarily be different. They report the findings under a given set of conditions, which may not recur completely another year or in another locality. Most of them are influenced by factors which it is impossible for the experimenter to take full account of because he does not know the measure of them. The conditions of experiment differ therefore from the control conditions of the laboratory.

The aim of many experiments is to get a relatively quick result, without resorting to the precision and detail of thorough-going investigation. In many cases this meets the immediate need of the problem and of practice. To know that fall plowing, for example, better prepares the land in a given locality for a particular crop is quite sufficient, and to determine just why this is true would probably involve a more intricate series of investigations than we are at present able to carry out, there are so many factors of soil, moisture, biology, and chemical and physical change to be taken into account, On the other hand, many classes of experiments are of such a kind or have been so often repeated and checked under varying conditions that quite broad generalizations may be drawn from them.

Taken as a whole, this grade of inquiry has been of inestimable service to American agriculture, in developing practical methods, leading to a broader undertaking, and making farming a more intellectual and profitable occupation. There is still need for work of this class and provision is made for it in the federal appropriations For many years to come it will very properly constitute a large share of experiment station effort.

But, like research, it should be progressive, recognizing that advancement depends on building upon the things that have become known. After a certain number of experiments on a given topic have been made it is well to consider whether it is worth while to continue them. In certain classes of such work there is an endless number of different combinations which may be made, but most of these may give no new results of value. The experimenter using public funds should be careful not to extend such work beyond what is actually needed. At the present stage we must regard certain facts as practically established, in so far as it is possible to establish them by the methods employed, and direct our effort to other lines of inquiry, rather than

move in circles. The methods, also, should be progressive, in order that gradually questions may be dealt with in a way to give a more enduring and intelligent answer; and, finally, these experiments, whose limitations are recognised, will often suggest subjects for systematic research. For we need a broader foundation of definite agricultural knowledge, and the methods of the ordinary isolated experiment can not alone furnish the foundation for a science and a well-rounded theory of American agriculture.

The line which separates the ordinary experiment from a demonstration trial is a changing one. What is an experiment in a new field this year may be a subject for demonstration trials next year or the year to come, and the provision of agencies for demonstration should lead to a closer scrutiny of the experiments conducted by the station, often with the result of elimination. The experimental work and the demonstration work represent separate fields. They should not overlap, and the desire of the station man to test out locally the result of his experimental findings should not lead into a series of purely demonstration trials.

The field experimenter is justified in repeating his experiments on different types of soil or under different climatic conditions sufficiently to test the validity of his deductions in the principal agricultural regions of the States; but it is useless for him to attempt experiments on hundreds of farms when the probability is that all the essential features of the experiment will be covered by a very limited number. Indeed, it may well be questioned whether he is within his field as a station man in doing so. One effect of this outlying work, where carefully done, has been to emphasize the distinction between an experiment made to secure information and a demonstration designed to impart it. The experiment to be of general value must be made under control conditions, and not be subject to the convenience or judgment of the farmer, who rarely understands the necessity for method and precision. Field experiments which are not thoroughly supervised and controlled by trained experts have little experimental value, and hence stations which are doing careful work make the absolute control of the land and direction of the work a condition of local experiments. This is not usually required or thought desirable in the case of demonstration trials, which indicates a distinct difference in the character of the two lines. It might reasonably mark a boundary line between them.

There comes a time when the result of experiment must be given to the public, through the bulletins and other agencies for getting it before the people. That time comes when the experimenter is reasonably sure of the accuracy of his results when his work has passed the experimental stage. Then it is ready to be taught. There should be no hesitancy on his part to then pass it over to the extension department through which it will be demonstrated to the farmers of the State. On the contrary, considering the great number of problems needing solution, the station worker ought to welcome the presence of the demonstrator, and be eager to get as many suggestions as possible from his attempts to teach the results to the farmers. If the author of the work serves in the dual capacity of experimenter and demonstrator, he should be just as careful to keep the distinctions of the two types of service clearly in mind.

But the time is here in many States, and rapidly approaching in others, when a man must be content to be primarily one thing or the other, an experimenter or a demonstrator. He must make the choice, for the opportunity lies open in both fields. It is well that he should consider the work and his interests carefully and then choose, and having made his choice to shape his work accordingly.

THE DATE PALM

An easy and well paying culture, produces delicious fruit of great food value at low cost and with a small labour force.

From the **Official Report** of an Agricultural Department we take the following notes:

"It is confidently believed that date culture is one of the most profitable fruit industries and that it will pay to plant date palms on the best lands employing modern horticultural methods.

The amount of labour and care required by the date palm is much less than that necessary for any other fruit trees. The gathering of the fruit is performed easily and quickly by cutting off a whole bunch at a time.

"The Date Palm is almost as important as a shelter and partial shade for other trees and plants as it is for its own fruit."

We Supply Date Palm Seeds of two varieties at the following prices:

Phoenix D. Sapida, a strong and resisting tree, demands no special care, but yields plenty of nice and soft fruit:

On receipt of 3 Shillings we forward about 10 ounces seeds (in full fruit) as sample of no value, under registered postage paid.

On receipt of £1.-, –Sterling=10 lbs. nett, by parcel post, postage paid.

Phoenix D. Nobilis requires more attention and plenty of heat; it produces a high class fruit of excellent flavour:

On receipt of 3s. 6d. we forward about 10 ounces seeds (in full fruit) as sample of no value, under registered postage paid.

On receipt of £1.5.--Sterling=10 lbs. nett, by parcel post, postage paid.

Prices for quantities on application. Detailed instructions for cultivation with every order.

Never buy Date Seeds in Kernels, as such, i.e., without the pulp, they easily lose the germination power and offer no guarantee that the trees will produce soft dates, for a dry or hard date is absolutely valueless.—We therefore supply date palm seeds only in the original fruit.

GEVEKOHT & WEDEKIND, Hamburg 1.

IS THE EARTH DRYING UP?

Prof. J. W. GREGORY, D.Sc., F.R.S.

SUMMARY OF CONCLUSIONS.

Owing to the varied nature of the evidence to be considered, the extensive and scattered literature whence much of that evidence has to be gleaned, and the contradictory opinions expressed by high authorities, the problem whether the Earth is drying up is hedged about with difficulties. But one fact does seem to me to result clearly from the evidence; there have been many widespread climatic changes in late geologic times, while in historic times there has been no world-wide change of climate.

If we consider particularly countries, such as Eygpt and Palestine, the balance of expert opinion is strongly in favour of the view that there has been no climatic change in either since the earliest existing records. The belief in a lesser rainfall in Palestine has been fostered by the oft-repeated comparison of the Hebrews between the stony wilderness of Sinai and the matured fertility of Canaan. But it may be concluded from the most precise tests now available, from the range of the date palm and the vine, and from the facts recorded by Old Testament writers, that the climate of Palestine is the same to-day as in the time of Moses.

Returning to the wider question—geological evidence shows how the passage from the climate of the Glacial Period to that of our own day has proceeded on two main lines. In some countries there has been a gradual rise in temperature since the disappearance of the ice, accompanied either by an increase or decrease in humidity. In other countries the glacial conditions were succeeded by a warm, dry period, followed again by wetter conditions. This increased humidity characterizes the present climates of Scandinavia, Germany, Hungary, Roumania, the eastern and southern parts of North America, parts of Africa from Nigeria to Cape Colony, and there is some evidence (see e.g. Raw, 1913) of the same change following a dry post-glacial period in England. As an increased rainfall has been demonstrated for so many parts of the world, it is only natural to expect a compensating decrease in other districts; and there is accordingly a predisposition to accept the claim that Central Asia is suffering from increasing desiccation.

Yet it is well to remember that the extent of such change may be easily exaggerated by attributing to recent climatic changes the effects of prehistoric variations. For archæological and historical evidence shows that Central Asia and even the coasts of Persia and Baluchistan had a very arid climate in the earliest times of which we have human records, that the Caspian Sea was at least as small and as low in the fifth century as it is now, and that the African and Asiatic deserts are in places again passing under cultivation. Though it must be admitted that, while there is a strong balance of opinion in favour of the view that the aridity in Asia is being still increased, there are weighty authorities on the other side.

The explanation of the conflicting views may be that in Central Asia the desert is widening in some places and contracting elsewhere. That the total rainfall in Central Asia has diminished is, however, probable as an accompaniment to its increase in parts of Europe. Variations in the distribution of rainfall must result from any considerable alteration in the level of the land; the uplift of a continent must cause the rainfall to become heavier on the margins and lighter in the interior. The increase of rain on the coastlands would however hasten their lowering by denudation, and again the rain would sweep over the interior; hence that marvellous geographical equilibrium, which has rendered possible the unbroken course of evolution, would in time, unless checked by renewed uplifts of the coastlands, restore the more even distribution of the rain and revive the desolate regions in the heart of a continent.—The Geographical Journal.

STORING MAIZE.

The Queensland Agricultural Journal contains a reprinted account from the Agricultural Journal of India of some interesting and conclusive experiments carried out by Mr. A. J. Grove, M.Sc., Officiating Imperial Entomologist. The following is an extract:—

A comparison of all the results recorded shows that storing with naphthalene is practically as effective as fumigation with carbon bisulphide, that it has no bad effect on the grain from the point of view of its suitability as food for cattle, and also does not alter the germinative capacity to any appreciable extent. It is therefore a much more suitable compound to use for preserving grain than carbon bisulphide, its advantages over that insecticide being:—

(1) It is quite easy to use. Carbon bisulphide is an extremely volatile liquid, and the vapour when mixed with air forms a very explosive gas. This necessitates extremely careful use, as in inexperienced hands it may prove dangerous.

(2) No special apparatus is required, the only precaution necessary is that the naphthalene should be enclosed in muslin or some such porous material to prevent it becoming mixed up with the grain. With carbon bisulphide a special fumigating house is essential, and this is costly to build.

(3) The cost is much less. This is very important. Flaked naphthalene costs Rs. 16 a cwt., or say 3 annas a lb. The charge used was 1 lb. per bin holding twenty-five maunds (1 maund=25 lb.) and of this after eleven months only about a half had evaporated (in bin B $23\frac{3}{4}$ tolas (80 tolas=2 1/7 lb.) were left, and in bin D2 23 tolas). For the fumigation of the maize used in this experiment—that is to say, roughly, 100 maunds—7 lb. of carbon bisulphide were required, the fumigating house only accommodating about sixty maunds at a time, and the charge for the house at 5 lb. per 1,000 cubic ft. being $3\frac{1}{2}$ lb. The cost of this alone, exclusive of the additional cost of labour required to cart the grain to the fumigating house and then back to the store, was about Rs. 7., the cost of carbon bisulphide being Rs. 12 a gallon. The charge of naphthalene of a similar quantity for maize would be 4 lb., of which only a half would be expended, and the cost of which would be 12 annas.

(4) The effect is continuous, as the naphthalene is stored along with the grain. The effect of fumigating with carbon bisulphide is to kill all the insects, larvæ, and eggs in the grain at the time, but after fumigating the carbon bisulphide must be allowed to evaporate, and any insects which found access to the grain could breed unchecked. The effect of the naphthalene is constantly to keep the insects in check. This is proved from a comparison of bins or bottles A and B, which contained exactly similar grain, and from the condition of A at the end of the experiment, must have contained insects at the time of storing. The insects in A bred unchecked, whereas in B they were not able to do so, with the result that the grain in B was as good as that in C, in which the insects were all killed by the carbon bisulphide, and insects prevented as far as possible from gaining access to the grain.

The use of naphthalene then is a simple way in which grain kept for fodder and for other purposes may be preserved from damage by insects, the only things to be remembered being that the naphthalene should be prevented from becoming mixed with the grain,* by enclosing it in muslin, and that the grain should be exposed in the sun for from six to twelve hours before feeding the cattle.—QUEENSLAND AGRIC. JOURNAL.

THE WORK OF THE SCIENTIST.

SIR CHARLES LUCAS in a recent speech thus refers to the services rendered by scientific men:—

"We talk much about lawyers and statesmen and legislators, but what have they done beside inventors, engineers, doctors and scientists to mould the earth and alter the lives of mankind? I should like to hear a great deal less about legislators and a great deal more about scientific men. The future of the British Empire depends more than anything upon the work of scientific men."

* In this connection the use of naphthalene balls may suggest itself, but flaked naphthalene is cheaper, gives off vapour more easily, and above all, it is much easier to take out a package of muslin than to search for a number of loose balls which might easily be overlooked or broken up.

By Appointment. **FISONS' (IPSWICH) FERTILIZERS** By Appointment.

For Tea, Rubber, Coffee, "The Best in the World." Sugar, Tobacco, &c.

These Fertilizers are manufactured to suit every soil, crop, and climate. They show a handsome profit to the importing houses, and have for many years past been used in all parts of the world.

SHEEP DIPS. DISINFECTANTS. INSECTICIDES.

Full Particulars sent post free on application to

Joseph Fison & Co., Ltd., Ipswich, England.

Fertilizer Manufacturers to His Majesty the King.

PEPPER.

[Sinhalese, "Gammiris;" Tamil, "Molavu"]

Illustrated

Renewed interest has of late been evinced in the cultivation of pepper as a minor or subsidiary product in Ceylon. The production of the crop, once the vines are planted and well established, involves but little labour, and the harvesting of the berries can be done by boys and women. The following description and particulars are taken from MACMILLAN'S HANDBOOK OF TROPICAL GARDENING & PLANTING:—The Pepper plant (*Piper nigrum*, N. O. Piperaceæ) is a creeping perennial vine, indigenous to the moist low-country forests of Ceylon and South India. Both "black" and "white" peppers are obtained from the same plant. The berries (pepper-corns) when of a reddish colour are picked and spread in the sun, when they become black and shrivelled. These, when ground with the outer covering left on, form "black pepper;" deprived of the black covering (first by soaking in water for 7 or 8 days, then rubbed or macerated with the feet or otherwise) "white pepper" is obtained. A decorticating machine has, however, been invented by which the dried black corns can be converted into white pepper. The pepper vine requires a moist heat with shade, and thrives up to 1,500 feet above sea level. Artificial or natural supports, in the form of posts or trees, are necessary, the latter form being preferable and more durable. Erythrina, Mango, Jak and other quick-growing trees answer well for the purpose of supports, while they also provide a beneficial light shade. In Sumatra and Malaya, posts of some hard and durable wood are commonly used for supports. Propagation is best by cuttings, which should be selected from the ends of the best bearing vines, and may either be started in a nursery bed, or planted out *in situ* where they are to remain. A small crop may be expected in the

third year from planting, but the vines will not be in full bearing till the sixth or seventh year. In India, Malaya, and Ceylon, the main crop is produced usually from March to May, and a smaller crop may sometimes be obtained in August or September.

Photo by H. F. Macmillan

PEPPER. *(PIPER NIGRUM.)*

It is considered that, with cultivation, an annual yield of about 2,000 lb. or more per acre should be obtained, allowing for the plants (stools) to be planted by 7 ft. by 7 ft., say, 880 to the acre.

The most economical method of Pepper cultivation is to grow the vines on trees which are used as shade along roadsides or for other crops, as "Dadaps" in Tea or Cacao, the cultivation in this case costing but very little. Pepper plants will continue to yield good crops for twenty-five to thirty years. The present market price of "black-pepper" in London ranges from 4*d*. to 5½*d*. per lb., "white pepper" usually fetching 2*d*. to 3*d*. per lb. more. The chief sources of supply are Penang, Sumatra, and Malabar. Ceylon exported over 350 tons of pepper in 1912, valued at £15,750.

H. F. M.

Photo by H. F. Macmillan

HARVEST NO. PEPPER

THE PALMYRA PALM.

[*See Frontispiece.*]

HISTORY AND NATIVE HABITAT.

The Palmyra (*Borassus flabellifer*) belongs to the aristocrats of the palm tribe, and has a history which is rivalled only by its confrères the Coconut and Date palms. The history of the Palmyra Palm is lost in hoary antiquity, and even the knowledge available regarding its native habitat is obscure. Though found throughout the plains of India, Burma, Java and in the northern drier region of Ceylon, it is nowhere in Asia considered to be indigenous. It is claimed to exist in a wild state in parts of Eastern Tropical Africa, and it is surmised that this must be its original habitat. In Ceylon, however, it has found a congenial home, having become quite naturalised in the sandy flat tracts of the north of the Island, forming regular forests in some cases. Here it reproduces itself freely, the large fibrous seeds remaining buried in the sandy soil until they absorb sufficient moisture to enable them to germinate, after which they sprout rapidly. In this connection RUMPHIUS wrote about the middle of the eighteenth century: "The tree is for the most part found to the east of Ceylon, especially in Jaffna, and from thence throughout the coast of Coromandel, also in Java and neighbouring islands. In Celebes there are vast woods of them about Gelissona and Mandura." The palm is naturally unsuited to the moist climate and alluvial or stiff soils, such as favour the Coconut palm; thus it takes the place of the latter in the drier coastal region, and is in many respects but little inferior to it; but it is by no means so handsome, nor so profitable to cultivate commercially as the Coconut.

"It is truly remarkable," wrote RUMPHIUS, "that these two palms, the Coconut and the Palmyra, cherish such secret envy and hatred towards each other that they will not grow in one and the same region. For we see that in all the western parts of Indostan and Ceylon, the Coconut tree grows abundantly and actively, but there we never or rarely see a Palmyra tree; on the contrary in Coromandel and the northern and eastern part of Ceylon the Palmyra predominates. I have seen in Amboina a Palmyra tree perfect and of full growth which had been cultivated with great labour, and was nevertheless always barren, from no other cause than that it stood amongst many Coconut trees." The superstitious writer was apparently not aware that the palm is diœcious, bearing male and female flowers on separate trees. It was probably a male tree that RUMPHIUS observed.

The *Index Kewensis* recognises four species of Borassus, including *B. flabellifer*. One of these is given as a native of Madagascar, another has its native habitat unknown, while the two others, including the Palmyra, are given as natives of India. But according to SIR JOSEPH HOOKER, the Palmyra is "apparently wild in Africa," and commonly found "cultivated in India, Burma, Malay," etc. This is also supported by TRIMEN, who considered the palm as naturalised, not indigenous, in Ceylon.

ANTIQUITY OF OLAS.

One of the most ancient ways of writing was upon palm leaves or olas, and it appears that Palmyra olas are among the oldest written articles on record. They are mentioned by PLINY as dating from early history. Hindu authors have traced the writing of olas back to over 4,000 years,—i.e., according to the Hindu reckoning. The late MR. WILLIAM FERGUSON, an authority on the subject, stated: "I do not doubt that palmyra-leaf MSS. 400 to 500 years old now exist in Ceylon. They are certainly of a more durable quality than paper, and indeed when well prepared resemble parchment in their texture." Considerable doubt, however, is cast upon the supposed lasting qualities of olas by recent writers.

It must be remembered that the leaves of the Talipot palm (*Corypha umbraculifera*) have also been used for olas from ancient times, and, like the Palmyra, are so employed till this day. Palmyra olas have, however, been claimed to be superior and to have greater durability. The leaves of the Coconut or other pinnate palms are not adapted for olas, and do not appear to have been used for the purpose.

The method of writing on olas is to produce impressions or scratches by means of a sharp-pointed iron stylus, the pen of the Scriptures, on the smooth surface of the leaf, the latter being first cut into uniform strips. The stylus, it will be recalled, was the instrument used by the Romans for writing upon leather, waxen tables and such like. Oriental customs die hard, and the writing on olas is still a practised art with some people, more particularly for deeds or important legal transactions. To see for the first time a clever ola-writer at work, is an interesting experience. He supports the leaf by the left hand and scratches the letters upon the surface with the stylus held in the right hand and supported over the thumb-nail of the left. The writing is done towards the right, but instead of moving the stylus onwards, the leaf is moved to the left. To render the characters more legible the engraved lines are generally smeared over with a mixture of oil and charcoal ; this tinges the writing and renders it more distinct. Frequently, however, fresh cow-dung is preferred for smearing over the surface, afterwards rubbing it off. The ola-writers rarely use tables, and can write standing or walking, but the usual posture is squatting down tailor-fashion.

USES OF THE PALMYRA.

The uses of the Palmyra almost surpasses in number those of the Coconut. Tamil poets, who have dedicated verses to it, can enumerate over 800 purposes which it serves, and even that does not exhaust the catalogue. In fact it has been considered an uneasy task to mention any domestic requirement which some part or other of the Palmyra does not supply. Houses are built and thatched with the stems (cut into beams and rafters) and leaves; the nuts supply food and drink, the juice of the fruit providing sugar, wine, or medicine; matting for floors or ceilings are made from the younger leaves, the latter being also readily made into fans, baskets, buckets, jugs, hats, caps, umbrellas, toys, etc. A Tamil proverb says: "Witchcraft is the easiest of all arts, and the Palmyra basket is the easiest of all plaits." In short it would be almost impossible to mention any part of the tree which does not serve some useful purpose. It furnishes a supply of fresh vegetable food in the following remarkable manner. The seeds are sown thickly in a bed, covered with earth and kept moist. In about four months they germinate, sending up a shoot. The latter develops a succulent thick base underground resembling an inverted parsnip; this is edible and is regarded as a choice vegetable. Collectively the seedlings are called by the Tamils "Kelangoos," which means "yams" or "bulbs;" these are taken up when two to three months old, and either eaten or despatched to market. To keep these kelangoos or yams for future use, they are deprived of the delicate parchment-like sheath in which they are completely enveloped, and then dried in the sun. When thus simply dried they are called "odials;" boiled first and then dried they are known as "*puluc* odials." The latter keep for many months in good condition, and are transported to different parts of Ceylon, being found in most bazaars at all times of the year and retailed at about one cent each, i.e. one-sixth of a penny. The flour made from the odials was once highly prized by the Dutch and, it is recorded, exported to Holland.

PALMYRA TODDY, JAGGERY, &c.

When the palm reaches the age of about 15 years from seed, the flowering spathes begin to appear among the leaves, near the top of the trees, which will then have attained a height varying from 8 to 15 feet. To obtain

the toddy the flowering spathe is securely tied up along its whole length to prevent the enclosed inflorescence from opening. It is then beaten or wounded by a mallet for three mornings successively, in order to assist the flow of toddy. After that it is ready for the operation of tapping, which consists in taking a thin slice off the end of the inflorescence each morning or evening (or both), until the whole of the latter is sliced away. The toddy is collected in earthen chatties, which are emptied morning and evening, the yield being about three quarts a day from each spathe. The process lasts for four or five months and is repeated for three successive years. The trees are then allowed to rest and develop their inflorescence naturally, otherwise, it is said, they will "pine and die." The toddy quickly ferments and becomes intoxicating, but the process of fermentation can be retarded by sprinkling the inside of the receptacle in which it is collected with lime, the result being "sweet toddy." Evaporation of the toddy by boiling produces a kind of brown sugar known as jaggery ; distilled, it furnishes the well-known spirit arrack.

DESCRIPTION.

The Palmyra is a short erect palm, ordinarily reaching a height of about seventy feet, but sometimes as much as 100 feet or more. It is curious the magnified sense of proportions with which the Tamils regard this palm, for if asked as to its height, remarked FERGUSON, they will quite probably answer 200 feet! I have put this to the test, and the answer, sure enough, was 250 feet. This exalted notion, however, apparently applies only to the Palmyra palm. A striking characteristic of the tree is its perfectly straight stem, which is never crooked or wavy, unless as a result of injury or accident, being thus the very reverse of its ally the Coconut palm. To quote another Tamil proverb: "A person who sees a straight coconut tree, a crooked palmyra, or a white crow will live for ever."

A Dutch writer, CORNELIUS, in describing the palm, wrote: "The trunk is like an iron cylinder, the perimetre of whose base is about 6 feet and that at the top about 3 feet. It is supposed to stand for about 1,000 years and lasts for the same period after being felled; in common proverb, a lakh after planted, a lakh after felled." The extraordinary longevity of the palm seems undisputed, but the estimates of the approximate age to which it attains vary exceedingly. Thus VYRAMUTU, of Point Pedro, estimated this at 500 years, as against CORNELIUS' 1,000 years, but even this more moderate estimate is doubtless slightly exaggerated.

The palm is diœcious, that is, male and female flowers are produced on separate trees; in other words, each tree is either male or female, and it is impossible to tell the sex until the trees flower, i.e., when about 12 or 15 years old. The inflorescences of both sexes are used for the extraction of toddy, but that from the male is considered of greater efficacy in native medicine.

The round globular fruits, about 4 to 5 inches in diameter, are smooth skinned and reddish-black in colour when ripe; they are produced in clusters (spadices) at the base of the leaves, each cluster containing from 10 to 15 fruits, being about as much as one man can carry. Each tree on an average bears seven or eight of these spadices or clusters, so that a tree often produces about 150 fruits in a season. The fruits when young are bluntly three-cornered, but when mature assume almost a perfectly globular appearance. Each ripe fruit contains one, two, or three "nuts" or seeds, embedded in a mass of soft yellowish pulp, intermixed with dark straw-coloured fibre. The seeds are oblong, flattened, and thickly covered with a mass of short fibre which adheres to them; in addition to this, each seed is protected by a thick shell which is so hard that even an elephant, according to the Tamils, cannot break it. "I have tried to break one with a hammer," says FERGUSON, "but the experiment is a dangerous one, the fruit flying off when struck with a

force sufficient to break a man's shins." When for some time in the ground, however, the shell becomes softer and the kernel expands, thus marking the initial stage of germination; as the latter proceeds, the space within the kernel becomes filled with a sweet cream coloured substance of the consistence of cheese, which is edible and considered a delicacy.

The stiff rigid fan-shaped leaves have comparatively short petioles or stalks, and radiate from the crown, giving the palm a distinctive character. A few years ago a sudden demand arose for the fibre obtained from the leaf bases, which is used for brooms and brushes, and the efforts made to supply this material threatened for a time to seriously affect the whole of the Palmyras in the Jaffna Peninsula, owing to the excessive stripping off of the leaves, followed by the death of many of the trees. DR. TRIMEN, late Director of the Royal Botanic Gardens, impressed by this wasteful procedure, proposed to enforce preventive measures by legislation. The practice still continues, but apparently not to the same extent as formerly, and the local headmen endeavour to restrict it within practicable limits.

The Palmyra ranks in importance to the Coconut palm in the Eastern tropics. Its chief commercial value consists in its fibre, above referred to, and in the laths made from the stem. Both these are important articles of export from Ceylon.

PLANTING.

In forming a palmyra plantation the seeds are best sown *in situ*, that is where the trees are to remain. This is usually at distances apart of about ten feet each way. The seeds take three to four months to germinate, and the trees should flower and fruit when fifteen years old, or earlier if well cultivated. Thus says an invocation to the Tamil goddess Ganesa: "O thou lady, resembling Laksimy who is seated on the beautiful red lotus. . . . When the stones (seeds) sprout and become tender plants, if you take good care of them, not to let the goat, sheep, cow or wild cow feed upon the plants, they will grow in strength, and the swords of their stems, armed with indented jags on both their sides, they will destroy the iron edge of poverty and protect the earth. When the Palmyra tree grows to the height of two bones length, the roots of the stems that fastened the tree will get dry and fall off in season. A female child and a Palmyra tree, it carefully nurtured, will become fruitful in the tenth year."

The palm is peculiarly adapted to hot, dry, sandy plains, as in the north of Ceylon, where the annual rainfall is almost confined to three months of the year, viz., from October to January. It will grow however in the moist region, as at Peradeniya, which is at an elevation of 1,550 feet, but here it is apparently "out of its element." The avenue shown in the frontispiece was planted from seeds sown *in situ* in 1887, so is now 27 years old. None of these trees have by any means attained their full size, and some are only a few feet high.

H. F. MACMILLAN.

THE CULTIVATION OF TEAK IN JAVA.

G. SCHAEFFER,

Java possesses at present upwards of 1,480,000 acres of teak forests, and this splendid asset increases every year, as the area reafforested is two and a half times larger than the area felled during the same time; on the other hand teak is nowhere cultivated except in Java. In the island the conditions required for the cultivation to be profitable are a fair soil of at least medium fertility, a minimum of 60 cm. (40 in.) of yearly rainfall and an altitude inferior to 100 m. (330 feet).

REGENERATION.

Teak sends up numerous shoots from the stool, but the trees thus obtained being much inferior to seedlings, this mode of regeneration is not utilized. The seeds are sown in holes in rows at 3 ft. by 10 ft Other crops, such as rice or earthnuts, are grown between the rows during the first year.

MAINTENANCE.

The greatest attention of the forester is devoted to preventing lalang-grass, (*Imperata arundinacea*) from invading the plantation; hoeing being too expensive, *Leucœna glauca*, a leguminous plant, is sown between the rows as a cover plant; it chokes the lalang and keeps the soil clean; besides which it prevents the leaching out of the soil and enriches it in humus and nitrogen and disappears when the cover of the forest is sufficient.

FELLING.

The new artificial forests are still too young to be felled; but it is estimated that the trees will attain a diameter of 24 inches at the age of 80 or 100 years.—Monthly Bulletin.

Sales of Produce in British and Continental Markets.

Fibres, Cotton, Grain, Oil Seeds, Hides and Skins, Timber, Rubber, Drugs, Wool, Ores, Mica, Gums, Tea, Cocoa, Coffee, Copra, Sugar, etc., are being regularly dealt in; Keymer, Son & Co., being selling Agents for Estates, Mills and Exporters.

Samples Valued.

Best Ports for Shipments Indicated.

THE MANAGEMENT OF

ESTATES UNDERTAKEN.

Capital found for the development or purchase of valuable properties.

KEYMER, SON & Co.,

Whitefriars.
LONDON, E.C.
(Same address since 1844.)

Cables:
KEYMER, LONDON.

PLANT & SEED SUPPLIES TO MEMBERS OF C.A.S.

A limited supply of grafted plants is now available to members of the Ceylon Agricultural Society at the Government Stock Garden, Colombo. The varieties include :—

Mangoes,	Other Varieties.		
Alponso or Badami	Lime	...	Bangalore variety
Raspuri	Lemon	...	do. do.
Mulgoa	Citron	...	Very large
Goa	Pomegranate	...	Bangalore large
Oranges	Sweetlime	...	Large fruited
Coorg	Guava	...	Pear
Satkadi	Roseapple	...	Bangalore variety
Nagpore	Grape	...	Black Hamburg
Sylhet	do.	...	Gordo Blanco
Other Varieties	do.	...	Muscat of Alexandria
Pomelo	Figs	...	Brown Turkey

N.B.—All these are grafted plants except Lemon, Grape and Fig.

The charge per plant will be Rs. 1·50 each, payable in advance, Orders with remittances, may be sent at once, giving instructions *re* despatch. Applications will receive attention in the order of receipt.

ENGLISH VEGETABLE SEEDS.

The usual supply has come to hand and is being distributed at the Government Stock Garden ; cost 10 cents per packet. Orders may be sent in now. The varieties available are :—

Artichoke	Endive
Asparagus	Fennel
Beans (Dwarf French)	Kohl Rabi (knol khol)
Beet	Leek
Borecole	Lettuce (Cos)
Broccoli	Lettuce (Cabbage
Brussels Sprouts	Onion
Cabbage	Parsley
Cabbage (Savoy)	Parsnip
Capsicum	Peas
Cardoon	Radish
Carrot	Rhubarb
Cauliflower	Salsify
Celery	Spinach
Chili	Tomato
Cucumber (ridge)	Turnip
Cress	Vegetable Marrow

The following seeds are also available at the Government Stock Garden for sale to members of the C. A. S. :—

1	bushel and 13 measures of Molagu Samba paddy				30	cts. p. m.
1	do	5 do	Sorghum		10	,, ,,
130 lb.	Maize	...	...	...	10	,, per lb.
523 ,,	Sunn-hemp	...	...	...	10	,, ,,
3 ,,	Cow Peas	...	...	...	25	,, ,,
53 ,,	Daincha (Sesbania aculeata)			...	30	,, ,,

C. DRIEBERG,

Secretary, C. A. S.

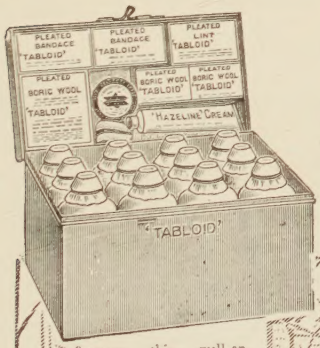
30-3-14.

EXPERIMENTS IN HUNGARY WITH HEMP SEED.

KAROLY GASZNER.

During the last three years the writer has conducted a series of comparative experiments with two varieties of hemp : one from Turkey-in-Asia, the other from Italy (Bologna). Of both varieties 62 lb. per acre were sown in rows $4\frac{3}{4}$ inches apart on several fields of 57 to 72 acres in area. The two varieties were sown at the same time and under similar conditions. In the Asiatic variety germination began 8 or 9 days after sowing, in the Italian 2 to 3 days later. The Asiatic hemp showed a more rapid development than the Italian, its stalk became thinner and more flexible and at the approach of flowering time it turned light green, whilst the Italian hemp kept its dark green colour to the end. On August 1, at the beginning of the harvest, the Asiatic hemp was about 6 inches taller than the Italian and in spots where the soil was most suitable it attained 10 feet in height. The result obtained from the two varieties showed also some difference : in 1912 the crop of Asiatic stalks was 186 lb. per acre in excess of the Italian, and in 1913, 288 lb. (The average quantity of hemp harvested in 1912 was above 83 cwt. per acre). The difference in the yield of the two varieties may be attributed to the denser germination of theAsiatic hemp,

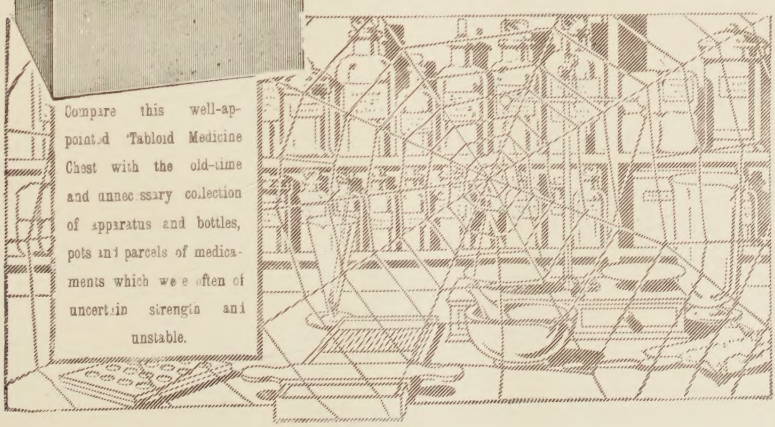
From these experiments the writer draws the conclusion that for the soils of Hungary, Asiatic hemp is more suitable. Its stalk becomes taller and it yields a finer and longer fibre, more suitable for the textile industry than the Italian variety. Nevertheless, the Asiatic seed has not yet been selected, as attention has only recently been paid to it. This is a task for the recently created Royal Hungarian Institute for the Cultivation of Flax and Hemp.—MONTHLY BULLETIN.



TRADE MARK 'TABLOID' BRAND

MEDICINE CASE No. 258

Contains pure and reliable medicaments in compact doses, ready and easy to take.



Dispensing made easy

No weighing No waste

Extremely light and climate-proof

Measures $8\frac{1}{4} \times 4\frac{3}{8} \times 5\frac{3}{4}$ in.

In Japanned Metal, of all the principal Chemists and Stores

BURROUGHS WELLCOME & CO., LONDON

NEW YORK MONTREAL SYDNEY CAPE TOWN MILAN SHANGHAI BUENOS AIRES BOMBAY

xx 976

All Rights Reserved

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.

	QUALITY.	Quotations.
ALOES, Socotrine cwt.	Fair to fine	40/ a 50/
Zanzibar & Hepatic ,,	Common to good	40/ a 70/
ARROWROOT (Natal) lb.	Fair to fine	6d a 7d
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair	£77/6 a £8 2/6
East Indian, bleached ,,	Fair to good	£8 10/a £8 15/
,, unbleached ,,	Dark to good genuine	£6 10/ a £7
Madagascar ,,	Dark to good palish	£7 17/6a £ 8 5/
CAMPHOR, Japan lb.	Refined	1/4½ a 1/6¼
China cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	6/ a 6/3
per lb	Middling lean	5/2 a 5/7
Malabar, Tellicherry ,,	Good to fine bold	6/ a 6/3
Calicut ,,	Brownish	3/11 a 5/8
Mangalore ,,	Med Brown to good bold	5/3 a 6/6
Ceylon, Mysore ,,	Small fair to fine plump	4/3 a 6/1
Malabar ,,	Fair to good	3/6 a 3/8
Seeds, E. I & Ceylon ,,	Fair to good	4/7 a 4/9
Ceylon "Long Wild" ,,	Shelly to good	2/3 a 3/6
CASTOR OIL, Calcutta ,,	Good 2nds	3¾d
CHILLIES, Zanzibar cwt.	Dull to fine bright	45/ a 50/
Japan ,,	Fair bright small	50/
CINCHONA BARK.—lb.	Crown, Renewed	3 3/16 d a 7 d
Ceylon	Org. Stem	2d a 6d
	Red Org Stem	1 3/4 d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/7
per lb. 2nds.	,, ,,	1/2 a 1/6
3rds.	,, ,,	1/1 a 1/5
4ths.	,, ,,	1/ a 1/3
Chips,	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	1/1 a 1/3
Amboyna ,,	Dull to fine	10d a 10½d
Zanzibar ,,	Fair and fine bright	5⅞d a 6½d
Madagascar ,,	Fair	7d
Stems ,,	Fair	3d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Native	Good ordinary	50/a 55/
Liberian ,,	Fair to bold	63/a 80/
COCOA, Ceylon Plant. ,,	Special Marks	81/ a 88/6
	Red to good	73/ a 80/6
Native Estate ,,	Ordinary to red	42/ a 68/
Java and Celebes ,,	Small to good red	30s a 93s
COLOMBO ROOT ,,	Middling to good	12/ 6a 21/
CROTON SEEDS, sifted,,	Dull to fair	40/ a 45/
CUBEBS ,, ,,	Ord. stalky to good	130/ a 150/
GINGER, Bengal, rough ,,	Fair	19/
Calicut, Cut A ,,	Medium to fine bold	60/ a 75/
B & C ,,	Small and medium	36/ a 60/
Cochin, Rough ,,	Common to fine bold	22/6 a 30/
	Small and D's	20/
Japan ,,	Unsplit	23/
GUM AMMONIACUM ,,	Ord. Blocky to fair clean	40/s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	70/ a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£5 a £7
Madagascar ,,	Fair to good palish	£4 a £8
	,, ,, red	£4 a £7
ARABIC, E. I. & Aden ,,	Ordinary to good pale	26/ a 30/
Turkey sorts ,,		32/ a 55/
Ghatti ,,	Sorts to fine pale	18/6 a 30/ nom.
Kurrachee ,,	Reddish to good pale	25 a 30s nom.
Madras ,,	Dark to fine pale	22/6 a 29/6 nom
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£ 6a £6 10/
	com. stony to good block	40s a £5
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	57/6 a 67/6
Somali ,,	,, ,,	52s 6d a 57s 6d
OLIBANUM, drop ,,	Good to fine white	45s a 50s
,,	Middling to fair	35s a 40s
pickings ,,	Low to good pale	15/ a 27/6
siftings ,,	Slightly foul to fine	18 s a 27s
INDIA RUBBER lb.	Fine Para smoked & sheets	26½
	Crepe ordinary to fine	2/6
Ceylon, Straits, ,,	Fine Block	2/5½
Malay Straits, etc. ,,	Scrap fair to fine	1/11 a 2/1
Assam ,,	Plantation	2/
,,	Fair 11 to ord. red No. 1.	1/6 a 1/9
Rangoon ,,	,, ,, ,,	1/3 a 1/6

	QUALITY.	QUOTATIONS.
INDIARUBBER lb.		
Borneo ,,	Common to good	9d a 1/4
Java ,,	Good to fine red	1/4 a 1/8
Penang ,,	Low white to prime red	9 d a 1/6
Mozambique ,,	Fair to fine red ball	1/10 a 2/4
,,	Sausage, fair to good	1/9 a 2/3
Nyassaland ,,	Fair to fine ball	1/9 a 2/1
Madagascar ,,	Fr. to fine pinky & white	1/6 a 1/8
,,	Majunga & blk coated	1/ a 1/3
,,	Niggers, low to good	6d a 1/6
New Guinea ,,	Ordinary to fine ball	1/4 a 1/7
INDIGO, E.I. Bengal ,,	Shipping mid to gd. violet	3s 3d a 3s 8d
,,	Consuming mid. to gd.	2s 9d a 3s 2d
,,	Ordinary to middling	2s 4d a 2s 9d
,,	Mid. to good Kurpah	1s 11d a 2s 5d
,,	Low to ordinary	1s 6d a 1s 9d
,,	Mid. to fine Madras	1/11 a 2/9
MACE, Bombay & Penang	Pale reddish to fine	2/4 a 2/6
per lb.	Ordinary to fair	2/ a 2/2
Java	,, ,, good pale	2/ 1a 2/4
Bombay	Wild	1/
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57 s	9½d a 10½d
	80's	7½d
	110's	6½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	11/ a 13/ nom.
per cwt. Bengal	,, ,,	10/6
Madras	,, ,,	10/6 a 11
OIL OF ANISEED lb.	Fair merchantable	5/11
CASSIA ,,	According to analysis	2/11 a 33/
LEMONGRASS oz.	Good flavour & colour	2½d
NUTMEG ,,	Dingy to white	1½d a 1⅜d
CINNAMON ,,	Ordinary to fair sweet	3½d a 1s 5d
CITRONELLE lb.	Bright & good flavour	1/6½
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	15/
Madagascar ,,	Fair	15/
Zanzibar ,,	Fair	15/
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5⅛d
Ceylon ,, ,,	Fair to fine bold heavy	5 a 5⅜d
Singapore ...	Fair	5d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore ,,	Fair to fine	8½d a8¾d
Siam ,,	Fair	8⅜d
Penang ,,	Fair	7⅜d
Muntok ,,	Fair	9d
RHUBARB, Shenzi ,,	Ordinary to good	2/ a 4/
Canton ,,	Ordinary to good	1/10 a 3/6
High Dried,,	Fair to fine flat	11/ a 1/1
	Dark to fair round	9 d a 11d
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ...	,, ,,	17/
small ...	,, ,,	13/ a 14/
Flour ..	Good pinky to white	10 a 11/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 75/
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Common specky & small	¼ d a 2½d
SHELLS, M. o' PEARL—		
Egyptian cwt.	Small to bold	82/6 a £6
Bombay ,,	,, ,,	60/ a £6 nom
Mergui ,,	Chicken to bold	£9 15 a £15
Manilla ,,	Fair to good	£7 10 a £11 10
Banda ,,	Sorts	60/ a 65
Green Snail ,,	Small to large	50/ a 82/6
Japan Ear ,,	Trimmed selected small to bold	30/ a £7
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	14/ a 15/
per cwt. Madras	Inferior to good	6/ a 10
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold	14/ 6 a 29/
	Pickings	8/ a 19/
TURMERIC, Bengal cwt.	Fair	10/6
Madras ,,	Finger fair to fine bold	14/ a 16 6
Do. ,,	Bulbs ,, ,, [bright	12/ a 13/
Cochin ,,	Finger fair	13/ nom
	Bulbs ,,	12/
VANILLOES— lb.		
Mauritius ... 1sts.	Gd. crystallized 3½a 8½a in.	10/ a 15/
Madagascar ... 2nds.	Foxy & reddish 3½a ,,	9/6 a 12/
Seychelles ... 3rds.	Lean and inferior	9/ a 10/
VERMILLION ... lbs.	Fine, pure, bright	2/8
WAX, Japan squares cwt.	Good white hard	54/

AN ILLUSTRATED HANDBOOK OF

Tropical Gardening and Planting

With Special Reference to Ceylon,

By H. F. MACMILLAN, F.L.S.,

Superintendent of Botanic Gardens, Ceylon.

About 300 Illustrations. Demy 8vo. 32 Chapters.

ABRIDGED SYNOPSIS:

I. Climate, Soils, &c.
II. Plant-life, nutrition, &c.
III. Manures, natural and artificial
IV. Green-manuring, mulching, inter-cropping, &c.
V. Soil operations: Tillage, rotation of crops, &c.
VI. Propagation; grafting, budding, &c.
VII. Cultural operations: Planting, transplanting, shading, pruning, ring-barking, &c.
VIII. Garden and estate tools and implements.
IX. Laying out gardens: choice of site, preparation of ground, paths, borders, lawns, pot-plants, verandah gardening, &c.
X. Tropical fruits.
XI. Sub-tropical or Temperate fruits.
XII. Tropical Vegetables or Food-products.
XIII. Sub-Tropical or Temperate Vegetables.
XIV. Spices of the tropics.
XV. Flowering and ornamental foliage trees.
XVI. Selections of foliage and flowering shrubs, climbers, palms, bamboos, &c., for low or medium elevations.
XVII. Selections of pot-plants: Foliage and flowering pot-plants, Orchids, Ferns, &c.
XVIII. Selections for medium or high elevations: Ornamental foliage & flowering trees, &c.
XIX. Sand-binding plants, trees, &c., suited to the sea-side.
XX. Shade trees for parks, field crops, Windbelts, Timber, &c.
XXI. Railway Rest-house and School Gardens; Memorial trees; Plants for Cemeteries &c
XXII. Standard products of Ceylon, Tea, Coconuts, Rubber, Cacao, Rice, Cardamoms, Tobacco, &c.
XXIII. Minor Products of Ceylon (Arecanuts, Annatto, Camphor, Cinchona, Citronella, Coca, Coffee, Cotton, Croton-oil, Kola-nut, Nux-vomica, Palmyrah, Sugar-cane, &c.
XXIV. Miscellaneous Economic Products of the Tropics: Edible products, Drugs, Oils, Dyes, Fibres, Guttahs, Tannins, Vegetable-wax, &c.
XXV. Perfume-yielding plants; honey plants; Ornamental seeds; curious fruits; poisons, &c.
XXVI. Pasture, grazing, fodder plants, Edible Herbs and flowers; medicinal plants.
XXVII. Garden and Estate enemies and friends; weeds, &c.
XXVIII. Insect pests, and termites. Insecticides, Fumigation, &c.
XXIX. Fungus diseases, preventive measures, fungicides. Spraying, &c.
XXX. Transport and packing of plants, seeds, bulbs, flowers, &c. Storing of seeds.
XXXI. Useful references; measuring land, trees, timber, &c. Recipes for jams, jellies, &c.
XXXII. Calendars of work.

Price exclusive of Postage, Rs. 10, or 13s. 4d.

Send for Complete Synopsis of Contents to the Author or

Messrs. H. W. Cave & Co., Colombo, Ceylon.

*Postage in Ceylon, cts. 50; to India and Burma, As 14; to other countries, 1s. 4d.

Photo by The Galle & Matara Photographic Coy.

COTTON AT AMBALANTOTA.

(*See article on page 505*).